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Vol. 7 No. 2

DIESEL MARINE ENGINES
FOR ALL CLASSES OF SHIPS

McINTOSH & SEYMOUR CORP.
AUBURN, N.Y.U.S.A.

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EXCLUSIVE technical and non-technical articles on design, construction and operation of oil-engines and motorships by the world's foremost writers on marine engineering.

MOTORSHIP

PROFUSELY illustrated with photographic reproductions of the newest designs in international merchant motorship and Diesel-engine construction and auxiliary equipment.

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(Cable Address—Freemote, New York)

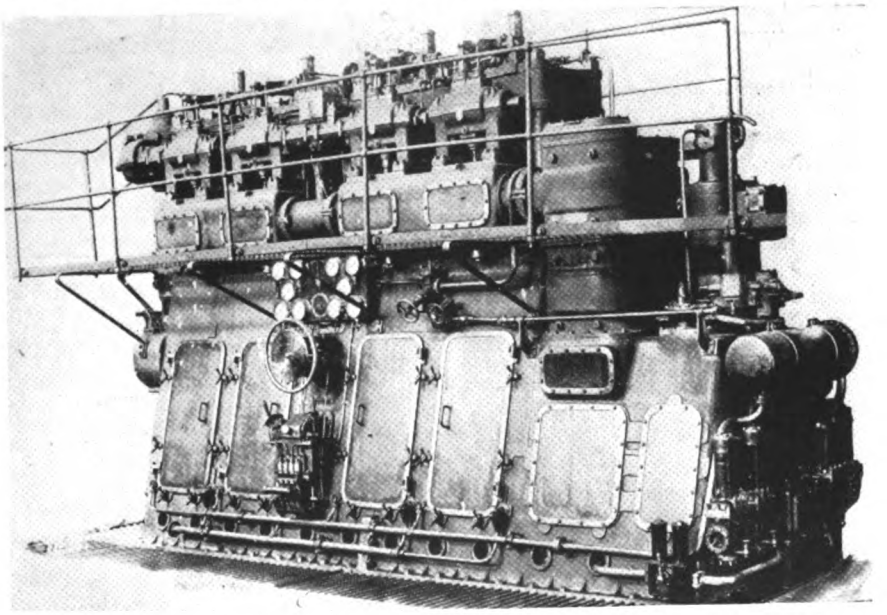
First American-Owned Diesel-Electric Merchant-Ship

Motorship "Fordonian" Runs Successful Trials. Excellent Conversion by Todds Shipyards Corp.

UNDOUBTABLY many American shipowners have been awaiting the placing in service of the "Fordonian" before definitely deciding upon the conversion of their uneconomical steamers to motor power. All in the mercantile-marine industry know that direct Diesel-drive is very suitable for converting steamships, provided the hull is of a type whereby the conversion can be carried out at a reasonable expense. All know too that Diesel-electric drive can be installed in almost any vessel from 50 to 30,000 tons. Consequently if owners have only been waiting for the advent of the "Fordonian," and if the results of her trials may be taken as a criterion, they need wait no longer because this vessel exceeded expectations on her sea tests held on Friday, January 13th. Both types of power may now be adopted with assurance.

Originally a Great Lakes freighter built in England in 1912, the "Fordonian" has recently been installed with new propelling-machinery to the order of the American-Mediterranean Steamship Company of New York (McDonnell and Truda, managers) the work having been carried-out by the Tebo plant of the Todd Shipyards Corporation. Her Diesel-engines were constructed in Italy by the Ansaldo-San Giorgio of Turin, while the electrical-machinery was manufactured by the General Electric Co., of Schnectady, N. Y. In her auxiliary equipment she has two American and two Italian surface-ignition oil-engines. So she is somewhat cosmopolitan. Although her hull is of excellent construction the vessel is by no means attractive in general design. Also the machinery is crowded in a very small compartment aft. But she will be a very economical ship in operation, which means much in these days. Already she has sailed for Cuba, where she will load sugar.

She was originally a single-screw ship, so it was decided not to change this, but to use her existing cast-iron propeller and steel shafting, which was designed to turn at 120 revolutions. Evidently her original engine could not maintain its full load because the vessel only used to make about 8 knots, compared with over 10 knots speed on her recent trials, which was averaged with the electric-motor operating at 720 shaft H.P. and with the propeller-blades partly out of the water. Captain C. D. Dyer, who commands the "Fordonian," stated after the tests that she far exceeded his best expectations, and demonstrated a remarkable ability to maneuver in the congested conditions in New York harbor, also he would not change for steam. The average speed on trial with the main Diesel developing 435 B.H.P. each was 10.12 knots. No fuel-consumption was measured.



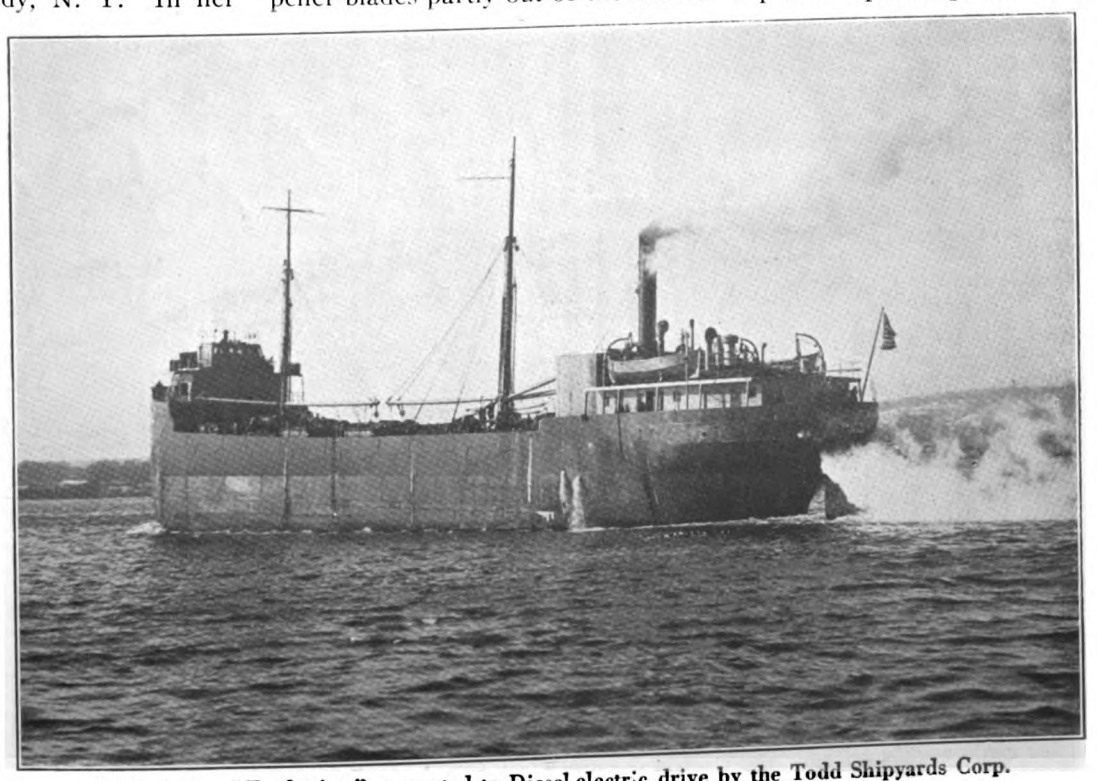
One of the twin 500 b.h.p. Ansaldo-San Giorgio two-cycle Diesel-engine of the "Fordonian"

As the electric-motor has plenty of power to spare—also the Diesel-engines, a large bronze propeller probably would give the vessel even better speed. Her dimensions are as follows:

Deadweight-capacity	2,200 tons
Power	750 shaft h.p.
Length	257 ft.
Breadth	42 ft., 6 in.
Depth	26 ft., 6 in.

Each of the twin-Diesel engines is of 400 to 500 brake horse-power, the revolutions being 10 to 200 per minute. Each is coupled to a 320 k.w., 250-volt General Electric direct-current generator, developing its output at 200 R.P.M. These generators furnish current to a General Electric double-armature motor of 850 brake horse-power, direct-connected to the propeller-shaft. Control of the electrical machinery is all in the engine-room, and consists of a panel on which are mounted V-switch field-rheostats, and these are arranged in a flat over the main engine. Included is a master controller for operating the contacters, and the control group for starting and reversing the motor, also a starting resister and a motor field resister for obtaining lower speed ranges of the propeller. The control arrangement allows for the use of either of both generators and motors, depending upon speed requirements. To ventilate the main motor there is a Sturtevant blower. As the two main Diesel developed 870 B.H.P. together, and as the electric motor on the shaft developed 720 B.H.P. there was a loss of power in transmission of 150 B.H.P.

Although a Diesel-electric vessel, she carries no electrician as part of her crew, although the guarantee-engineer from Schenectady as well as the guar-



The freighter "Fordonian" converted to Diesel-electric drive by the Todd Shipyards Corp.

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antee engineer from Turin will be with the vessel for a short while. Her regular engine-room crew consists of seven men, namely, chief-engineer, 3 engineers and 3 oilers.

Her Chief-Engineer is W. N. Hook, who was her original chief. K. Reichert, also an experienced motor-ship engineer, is the second engineer. The latter was for two years and four months one of the engineers of the American Manganese Bronze Co.'s Craig-Diesel engined vessel "Guanacasta," and also assisted in the erection of the new big Craig Diesel of the motorship "Suphenco," which will run trials in several months.

The reason for going abroad for the main Diesels, state the owners of the "Fordonian," was that there was very limited space for the engines, and they were not successful in inducing American Diesel-builders to construct engines of the power desired to fit the space. The firms they approached desired to take larger engines and rate them lower, and that using these engines meant too close a fit in the engine-room. We do not propose to discuss the facts of the case as we do not know both sides; but, our columns are open to any domestic engine-builder who desires to comment on Messrs. McDonnell and Truda's remarks.

The Ansaldo-San Giorgio Diesel-engines in the "Fordonian" are 5,445 MM. (17 ft. 10 in.) long overall by 1,840 MM. (6 ft. 3½ in.) wide and 3,100 MM. (10 ft. 2 in.) high from the center of the crank-shaft to the top of the injection-valve. Each weighs 32 tons. Undoubtedly they are of excellent design and workmanship, but changes will have to be made to the governor, which does not act quickly enough when the load is put-on and taken-off when maneuvering.

They are of the two-cycle type, each with four cylinders 15.354 inch bore by 21.653 inch stroke, and have a guaranteed fuel consumption of 0.42 pound per brake H.P. hour. They have crossheads and guides, which is not the general practice with American Diesel-engines of their power and speed, forced lubrication is fitted throughout.

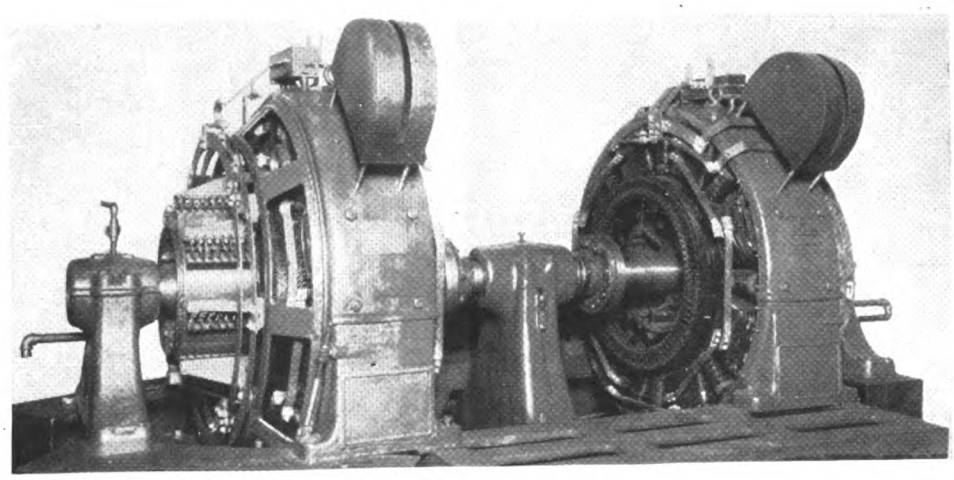
The cylinder-heads are connected together in pairs by steel boxes, which are bolted to the bed-plate by means of vertical steel-colums to avoid any strain on the cast-iron parts of the engine. In the cylinder-head the only valves are the fuel-injection valve, the starting-air valve and the safety-valve; the admission of the scavenging-air regulated by a special valve-being through ports in the lower part of the cylinder. Exhausting of the burned gases is carried-out in a similar manner. Actuation of the valve-gear is off a horizontal camshaft on a level with the cylinder-heads, which is operated by a vertical shaft off the crankshaft. Movement of the mechanism for reversing the engine is by a compressed-air servo-motor: starting being by compressed-air. Of course, reversing of the main Diesel-engines is not required in the "Fordonian," because all reversing is done by the electric control. In another installation we suggest that electric starting also be adopted. Forming part of the engine are the following:

(A) Two vertical double-acting superimposed scavenging-air pumps, driven-off an extension of the main crankshaft.

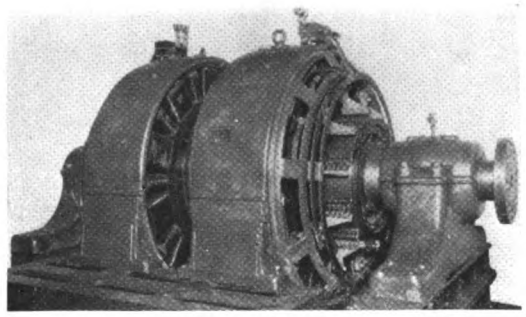
(B) One three-stage compressor for the injection and starting air driven directly by the crankshaft.

(C) Sea-water pumps for circulation and cooling of the main cylinders, main-bearings, compressors, water and oil coolers.

(D) Fresh-water pumps for cooling the main pistons.



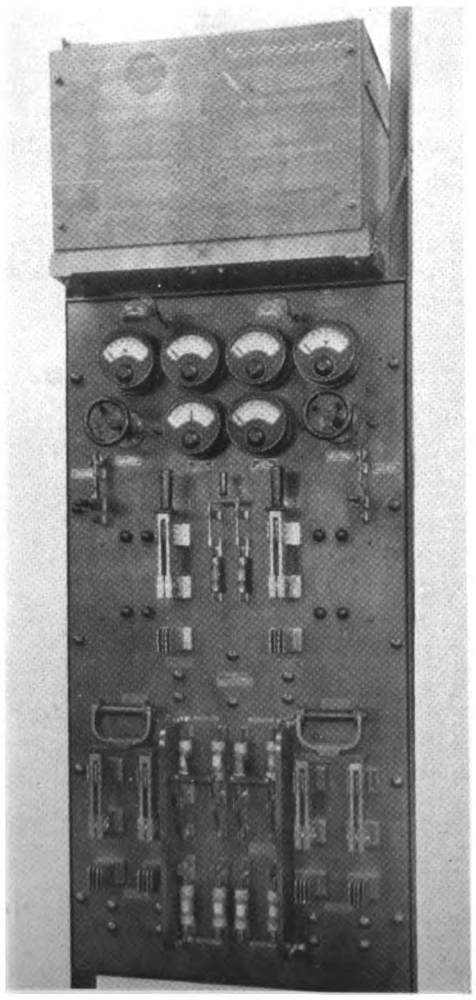
One of the electric-generators of the "Fordonian"



The "Fordonian's" propelling motor

(E) Lubricating-oil pumps, with filter and cooler.

(F) Pumps for the supply of fuel, and other services on board.



Control panel of M. S. "Fordonian"

For the deck machinery and for heating the ship there is an oil-fired donkey-boiler. On the trials this boiler revenged itself for the many unkind things we have said about the wicked waste of fuel under boilers, by suddenly blowing a jet of black oil over us and ruining a new overcoat, while our back was turned during a conversation with a G. E. C. man.

Above, on the port side of the engine-room there are two Venn Severin surface-ignition oil-engines driving auxiliary electric-generators for lighting, etc. On the port side there are two Ansaldo-San Giorgio surface-ignition oil-engine driven air-compressors, one set being a spare. On the main floor forward there are two Fairbanks-Morse electric-driven bilge-pumps.

The following visitors were on board during the trial:

P. Bryan, General Electric Company.
J. J. Brown, Westinghouse Electric Company.
A. F. E. Horn, General Electric Co., Washington, D. C.
G. Smith, U. S. Engineering Department.
T. R. Vogel, U. S. Engineering Department.
Lieut. Col. H. Allen, U. S. Engineering Department.
Com. S. M. Robinson, U. S. Navy.
Com. Jones, U. S. Navy.
Com. Walton, U. S. Coast Guard.
W. P. Morehouse, Penn. R. R. Company.
E. Keane, U. S. Government.
P. J. O'Reilly, U. S. Boiler Inspector.
H. Erhlich, Custom Inspector.
H. Westlake, Custom Inspector.
W. Richardson, Custom Inspector.
R. O. Dunham, General Electric Co., Schenectady, New York.
T. S. Candy, General Electric Co., Schenectady, New York.
B. S. Beach, General Electric Co., Schenectady, New York.
L. R. Ford, Worthington Pump & Mach. Corpn., New York.
L. V. Armstrong, Ingersoll-Rand Company, New York.
H. Schreck, Consulting Engineer, New York.
S. Wright, Busch-Sulzer Diesel Eng. Co., New York.
F. J. Moran, General Electric Co., Philadelphia.
M. J. Hekking, Texas Oil Company, New York.
Theodore D. Wells, Naval Architect, New York.
Thos. Orchard Lisle, Editor MOTORSHIP, New York.
C. H. Kennerly, Old Dominion Transportation Co., New York.
H. Lund, Chief-Engineer, Old Dominion Transportation Co., New York.
A. St. James, The Texas Company, New York.
N. R. Sibley, Westinghouse Electric Co., New York.
George L. Kay, American Bureau Survey, New York.
George Pogue, Busch Sulzer Diesel Eng. Company, New York.
F. B. Webster, Editor, MARINE ENGINEERING, New York.
W. M. Johnston, John Bliss & Company.
J. B. Bassett, General Electric Company, New York.
M. S. Katzenstein, Worthington Pump Co., New York.
L. G. Nunos, Ansaldo San Giorgio, Ltd., Turin, Italy.
G. Campiglio, Ansaldo San Giorgio, Ltd., Turin, Italy.
J. W. Anderson, New London Ship & Engine Company, Groton, Conn.
G. E. Edgar, New London Ship & Engine Company, Groton, Conn.
P. Levinthal, Naval Architect, New York.
A. Kennedy, General Electric Co., Schenectady, New York.
W. H. Wild, General Electric Co., Schenectady, New York.
J. Thomas, General Electric Co., Schenectady, New York.
P. McDonald, McDonell & Truda.
Paul Henning, U. S. Shipping Board, New York.
H. B. Taylor, U. S. Shipping Board, New York.

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Krupp's New Merchant-Ship Diesel-Engine

First Details of the Germaniawerft 2,000 I.H.P. Four-Cycle Type Marine Oil-Engine

By OTTO ALT

Chief-Engineer, Fried. Krupp's Germaniawerft, Kiel-Gaarden, Germany

IN an article published in the July, August and September issues of the "Motorship" of 1920, I mentioned that Krupps have a large number of merchant-ship Diesel-engines of a new four-cycle crosshead type under construction and gave preliminary drawings. The first of these engines of 1,400 B.H.P. (2,000 I.H.P.) has in the meantime been thoroughly tested on the test-bed at their Germania works, Kiel-Gaarden.

The results obtained are in every way satisfactory and interesting. This engine, which is now illustrated, has six working-cylinders of 650 millimeters (25.590 in.) bore and 1,000 millimeters (39.370 in.) stroke. When developing 1,400 B.H.P. at 125 revs. per min. the mean-effective piston-pressure therefore is about 71 lbs. per sq. inch. The fuel-consumption when developing 1,550 shaft h.p. is about 0.42 lb. per h.p. hour.

General Arrangement

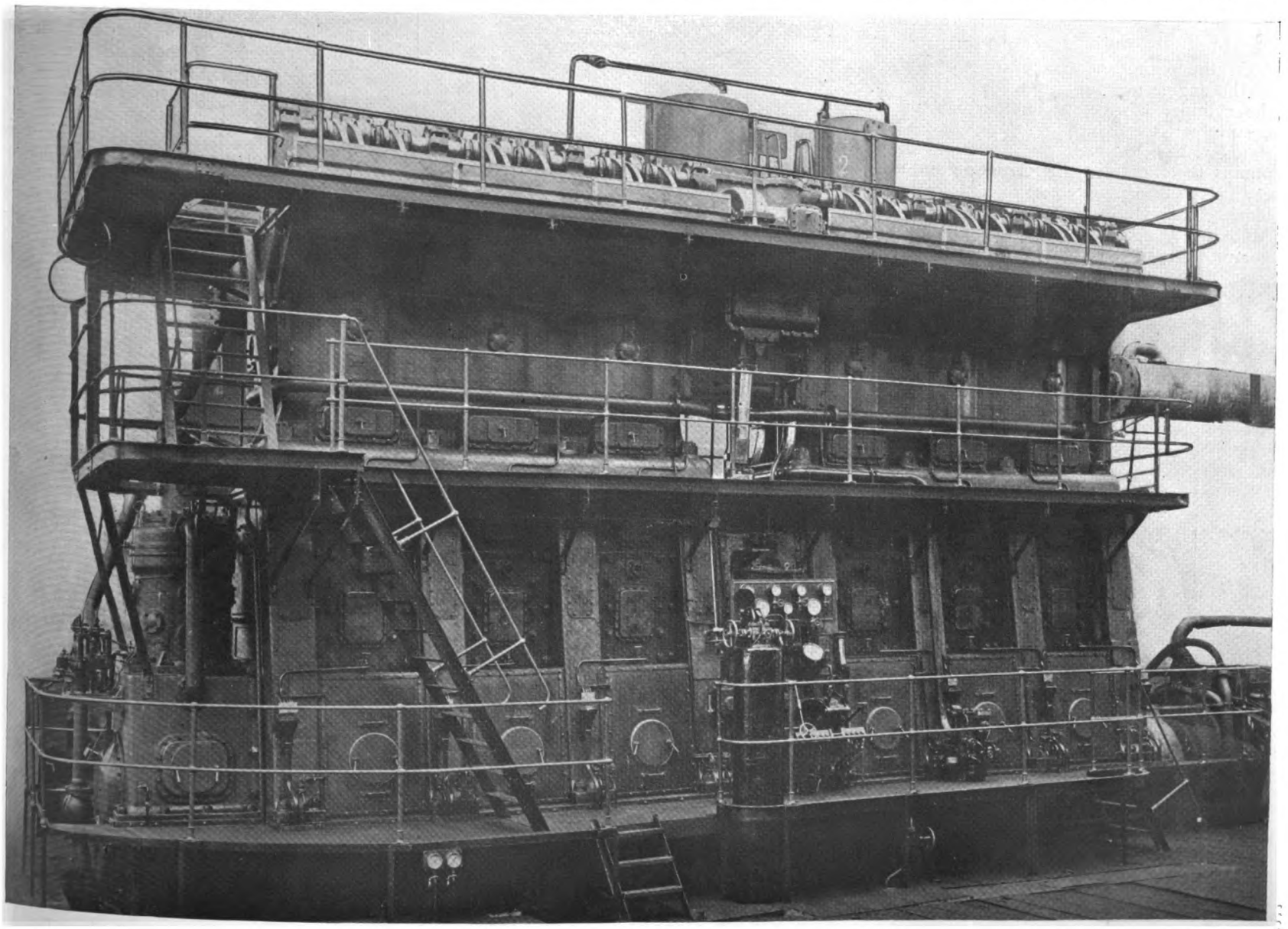
Construction of the engine is as follows:—a V-shaped cast-iron bed-plate with its oil-sump cast integral contains the eight main-bearings. Eight cast-iron frames, mounted on the bed-plate across the bearings and with the crosshead-guides bolted-up to them, carry the six cylinders. Three cylinders are cast in one box piece, both sets being connected by an intermediate box-frame of strong section so that the whole forms a rigid cylinder block. The six cylinder-heads are bolted to the block, also the brackets carrying the horizontal cam-shaft and valve-lever shaft. The manoeuvering platform with all the gear necessary for the operation of the engine and the oil-fuel pumps, is arranged in the centre on the front side of the engine at a convenient height from the floor plates. The fuel-pumps are actuated by a horizontal intermediate-shaft driven by the crankshaft through spur-gears having a ratio of 1 to 2. A vertical shaft, the upper bearings of which are contained in the intermediate box-frame, connects the intermediate horizontal shaft to the cam-shaft by means of bevel-gears. On the front side of the engine, level with the cylinder covers, is the cam-shaft. The flywheel and turning engine and the thrust-block of the Germaniawerft type are situated at the aft end; while the three-stage injection and starting air-compressor are mounted on a box-frame crank-case at the forward end of the engine.

Rigid connection of the various engine parts affords stiffness to the entire structure, so that during overload trials of 20 per cent increased speed at 150 R.P.M. no engine motion or vibration on the upper gallery, or on the intermediate frame between the cylinder boxes, was noticeable. All present at the tests were especially impressed by this fact.

A forged crank-shaft of ordinary open-hearth steel has been adopted, and this consists of two interchangeable three-crank sections, bolted together. A three-throw spare shaft can therefore replace any crank-shaft part of either starboard or port main engine. But, in place of the forged type, a crank-shaft of built-up construction can be supplied. The thrust-shaft is bolted to the after end of the crank-shaft and the compressor-crank is connected to the forward end. The bed-plate is oil-tight and the oil-sump of course, is provided with a sufficient number of oil drains. Of course, the crosshead guides are water cooled. All driving-gear bolts are especially strong, and the crank shaft and crosshead bearings have ample dimensions.

It may be of interest to record that a wrought-iron piston, cooled by sea-water, has been adopted, and is connected to the piston-rod by a large flange and bolts. Cylinder liners are of hard cast-iron, fitted free to expand in the cylinder block. Cylinder heads are of cast-iron and are provided with large cleaning holes, and the heads are so designed that the cooling water can circulate freely round each valve-chamber. Each head contains the fuel-injection, exhaust, inlet, starting and safety valves. The inlet-valve and exhaust-valve cages are of equal size and are interchangeable, but only the exhaust-valve cage is connected to the cooling-water system.

For normal-power outputs the exhaust-valve heads are not water-cooled, and in accordance with Krupp construction they are



Krupp six-cylinder 2,000 indicated horsepower merchant-ship Diesel Engine

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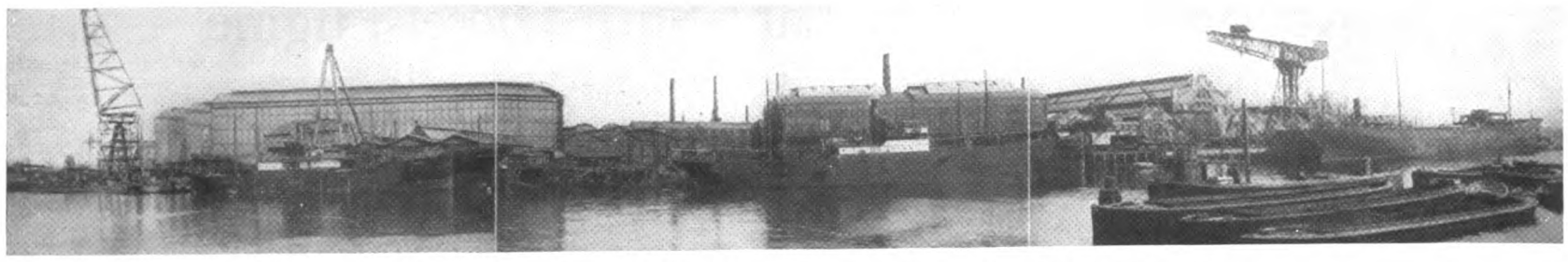
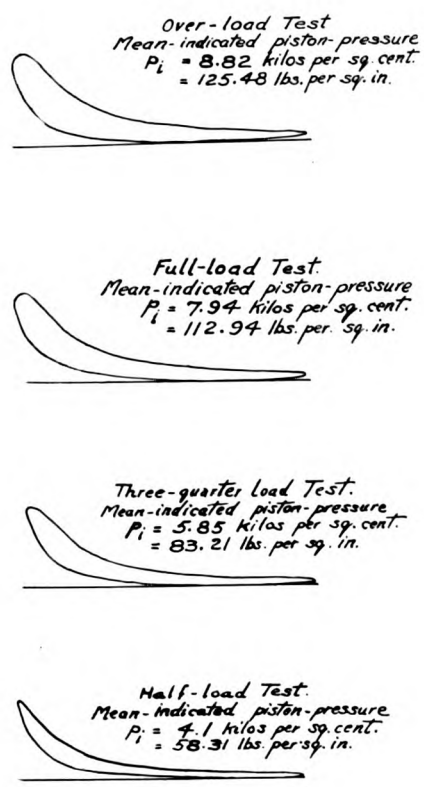


General view of Krupp Germania Diesel Engine Works and Shipyard, Kiel-Gaarden, Germany

provided with cast-iron plates fixed on the top of the wrought-iron valve-heads. For continuous higher powers the engines are fitted with water-cooled exhaust-valve heads not depicted in any of the illustrations accompanying this article. All the valves are driven direct from the cam-shaft by shortest levers possible. Unlike the working cylinder the compressor is without a crosshead, and has a three-stage piston, the intermediate stage being formed by the ring between the low-stage piston and the trunk carrying the connecting-rod pin. Pressure in the intermediate-stage acts on the bottom in the low-stage, and in the high stage on the top side of the piston. All valves are of the plate type with rings of Krupp special V2A steel of unlimited durability. Coolers for each stage consist of bundles of straight tubes with oil-separators below, and all are contained in a common cast-iron casing mounted on the back of the engine alongside the compressor. A safety-governor mounted on the vertical intermediate-shaft prevents engine racing in rough weather, and an injection-air-pressure controller regulates the pressure of the injection-air according to the load and speed, thus preventing excessive-pressure in the working-cylinders.

Of the pumps necessary for the working of the engine generally, only the oil-fuel and the cylinder lubricating pumps and the air-compressor are driven off the engine. Each cylinder has its own fuel pumps, all the pumps together with their suction-and-delivery valves being contained in a wrought-iron block. The cylinder lubricating-pumps, of the Möllerup type, are situated at the back of the engine, and are driven by the indicator driving-gear of each cylinder.


Over-load Test
Mean-indicated piston-pressure
P_i = 8.82 kilos per sq. cent.
= 125.48 lbs. per sq. in.
Full-load Test.
Mean-indicated piston-pressure
P_i = 7.94 kilos per sq. cent.
= 112.94 lbs. per sq. in.
Three-quarter load Test.
Mean-indicated piston-pressure
P_i = 5.85 kilos per sq. cent.
= 83.21 lbs. per sq. in.
Half-load Test.
Mean-indicated piston-pressure
P_i = 4.1 kilos per sq. cent.
= 58.31 lbs. per sq. in.
No-load Test.
Mean-indicated piston-pressure
P_i = 1.53 kilos per sq. cent.
= 21.78 lbs. per sq. in.

Indicator-cards taken on acceptance tests of Krupp engine, Feb. 22nd, 1921

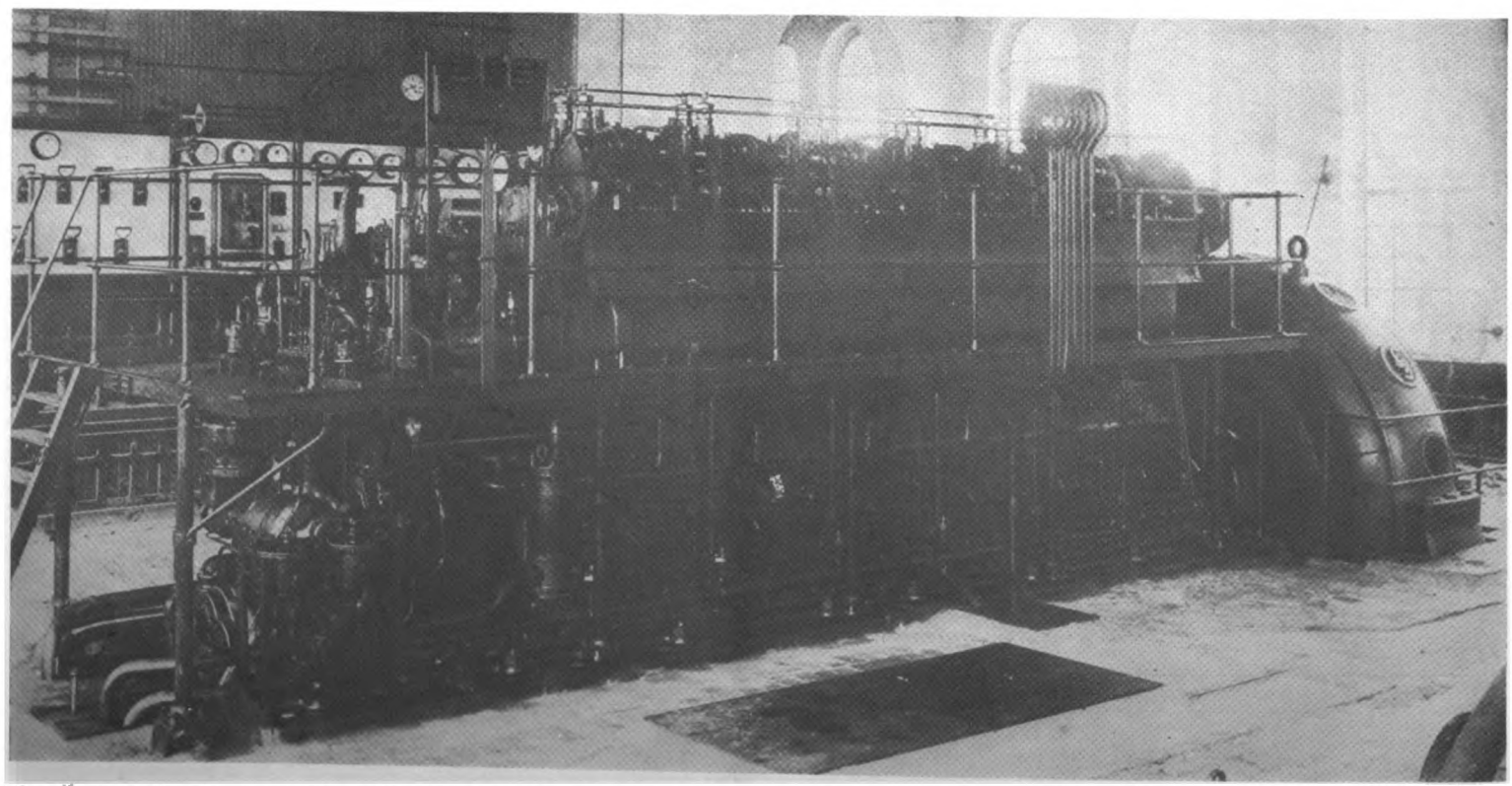
For single-screw vessels, and in cases where importance is attached to simplicity of the engine-room plant, also for twin-screw vessels, the pumps necessary for running the engine and ship such as cooling-water, lubricating pumps, bilge and deck-wash pumps (fire-pumps) may be driven off the main engine. In this case according to the practice of the Germaniawerft these are driven-off the compressor by a rocking beam.

Starting and Manoeuvring

All devices for regulating the fuel supply, starting and reversing, are arranged in the center of the engine in an accessible position and can be manipulated without effort. One lever regulates the fuel supply, another controls the starting-air, while a small hand-wheel operates the reversing engine. The reversing gear is not fitted on the engine shown in the photographs, as the first two engines of this marine design were supplied to a large electric-generating station.

In order to start the engine the fuel-control lever must first be moved from "stop" into the half-way position thereby opening the injection-air automatic stop-valve. Only then can the starting-air control-lever be moved-out of its "stop" position. The primary shifting of the latter brings the levers of the starting-air valves on the cylinders in connection with their cams, whilst its further movement into its working position opens the starting-air automatic stop-valve. As soon as the engine begins to revolve under starting-air the fuel control-lever is shifted over into its working position, thereby admitting the fuel, the engine immediately starts firing.

When sufficient speed has been attained the starting-air control-lever is brought back into



How Germany is using some of her submarine Diesel-engines. A 1,000 h.p. Krupp Diesel engine connected to electric-generator in a power plant. This picture should be of interest to shipowners because of the development of Diesel-electric drive for cargo-ships

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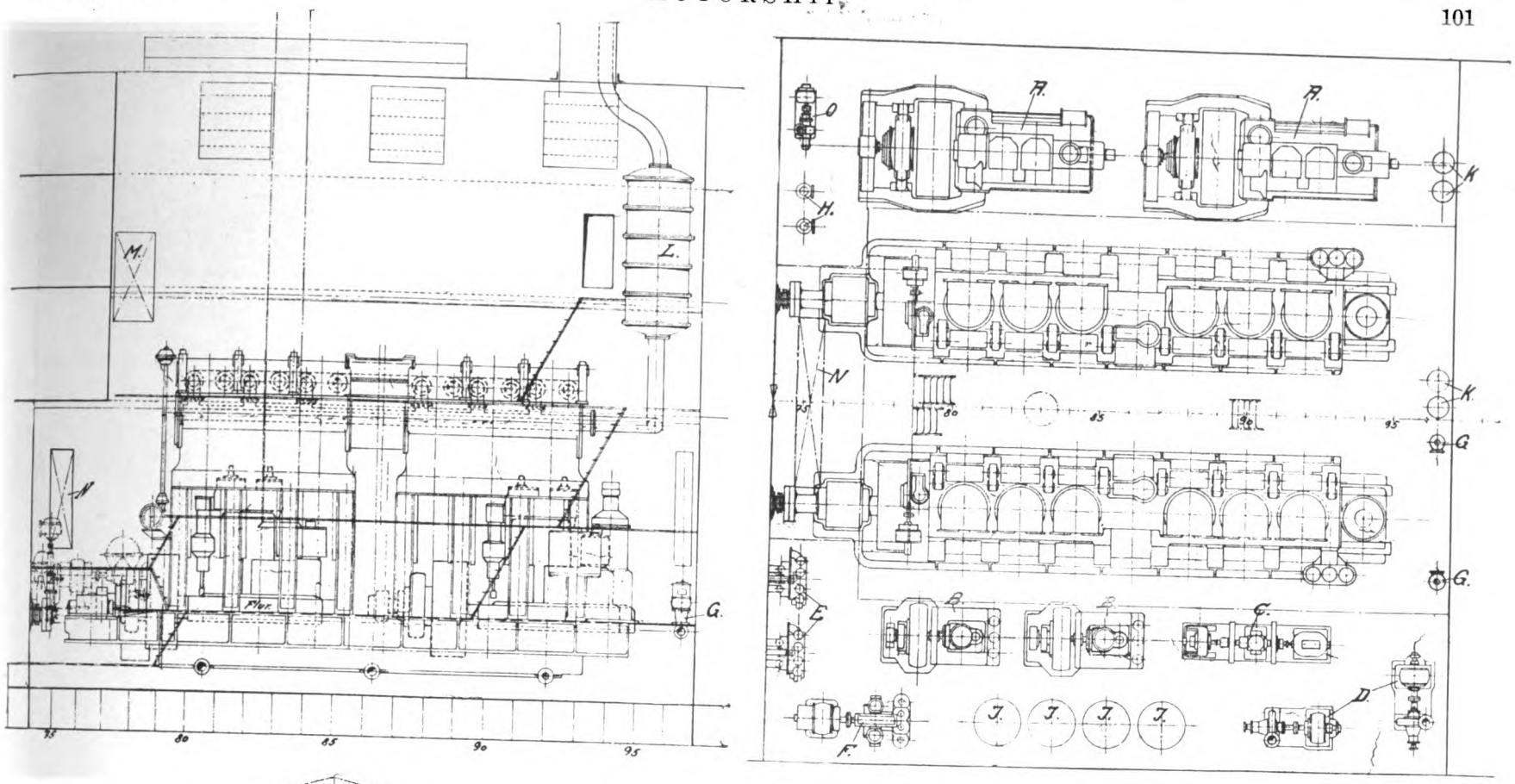
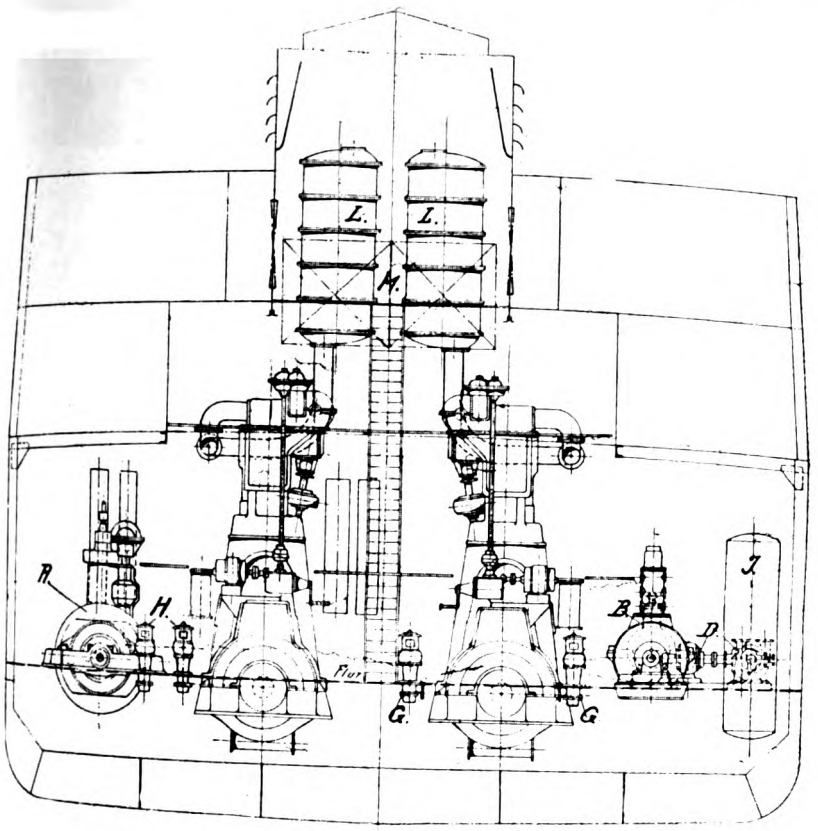




Auxiliaries and Accessories.

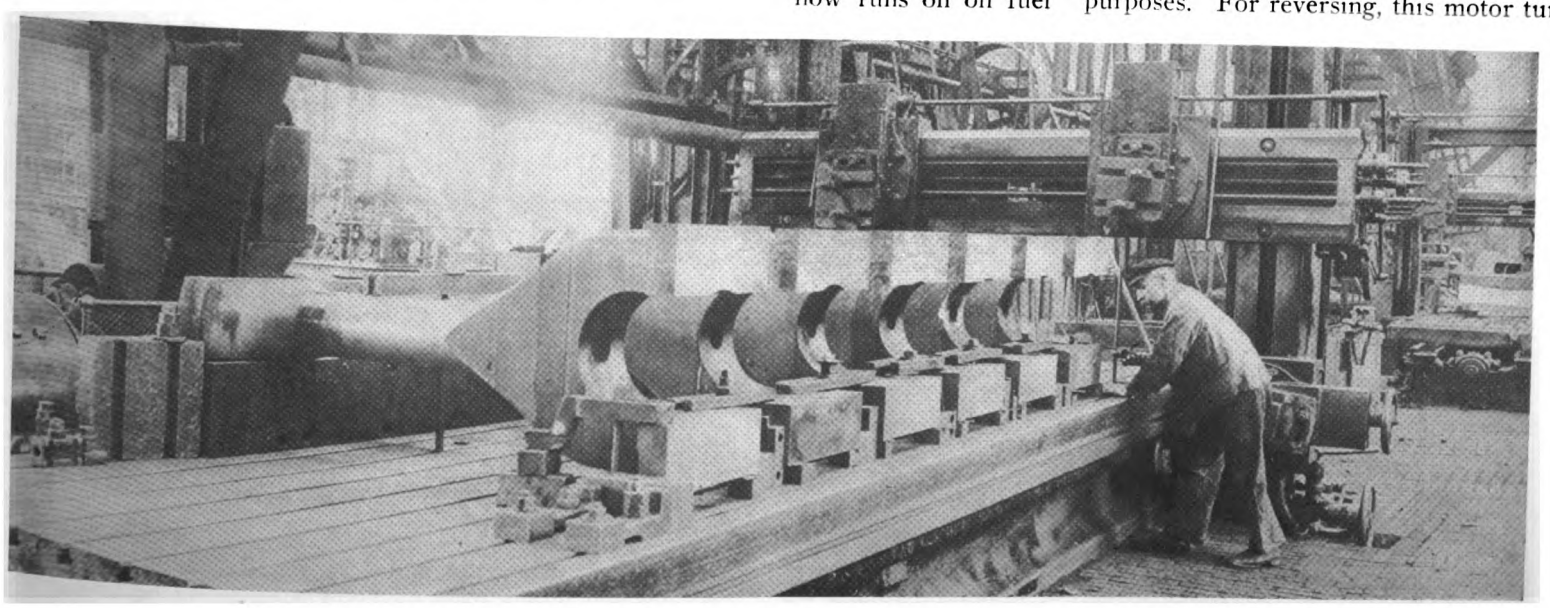
Sign	Number	Object.
A.	2	Diesel dynamos.
B.	2	Auxiliary compressors.
C.	1	Emergency lighting and compr. set.
D.	2	Cooling water circulating pump.
E.	2	" " discharge and bilgepump.
F.	1	Ballast pump.
G.	2	Crank chamber lubricating oilpump.
H.	2	Oil fuel filling up and taking over "
J.	4	starting air recievers.
K.	4	Injecting air recievers.
L.	2	Exhaust silencers for main engines.
M.	2	Oil fuel tanks.
N.	1	Switchboard.
O.	1	Fire extinguishing pump.

Engine-room lay-out of 7,700 tons motorship with twin Krupp four-cycle Diesel-engines of 1,400 shaft h.p. each

its "stop" position thus bringing the levers of the starting-air valves out of action and shutting-off the starting-air supply. The engine now runs on oil fuel alone in the ahead direction.

In the "stop" position of the fuel and air control-lever B, the injection-and-starting air piping on the engine are in connection with the atmosphere, and therefore are not under pressure. The automatic-valves are operated and the rockers of the starting-valves brought into action by air-pressure controlled by pilot-valves. These valves are actuated by the fuel and air control-levers and are arranged easily accessible in the valve-boxes.

Reversing the engine is accomplished by first bringing the fuel lever into the "stop" position, then by means of the servo-motor, which is controlled by a hand-wheel, shift the cam-shaft, so as to bring the reverse-cams into action and finally restarting the engine in the manner before described. The whole operation only takes a few seconds. Shifting of the cam-shaft is carried out by electric, or compressed-air motor, situated at the after end of the engine, which also serves for "turning" purposes. For reversing, this motor turns the



Method of machining Diesel-engine connecting-rods on a planer at the Krupp Works

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rocker-shaft on which the rockers are mounted eccentrically and thus first lifts them clear of the ahead-cams, then by means of the reversing-gear shifts the cam-shaft and finally brings the rockers down onto the astern-cams. The reversing-gear is situated in the box-frame in the middle of the engine and receives its motion from the rocker shaft.

The fuel-control lever, the air starting-lever, and the control-wheel of the reversing-gear are interlocked so that all operations can only be made in their proper sequence, and mistakes are impossible. Hand reversing-gear is also fitted.

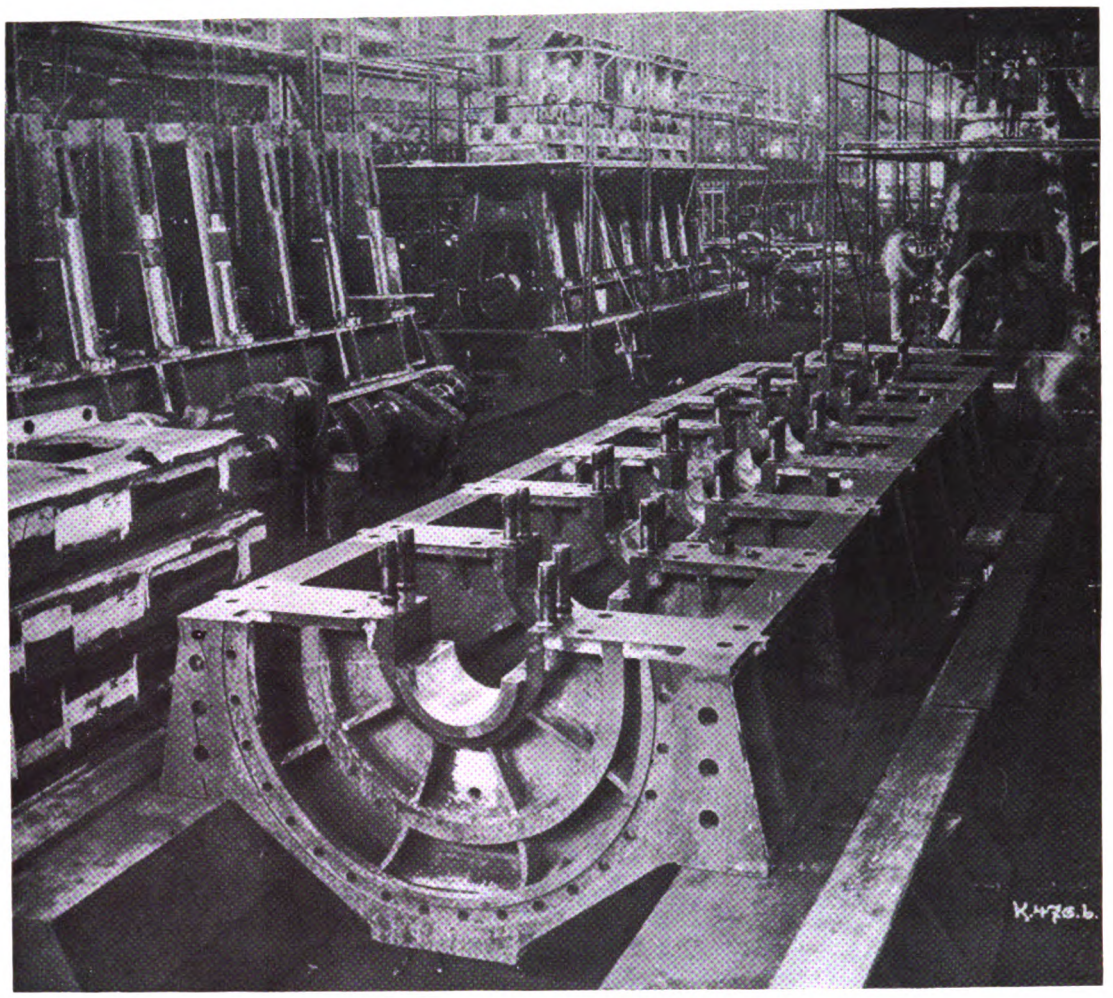
Lubricating and Cooling

Lubrication of the entire working-parts is carried-out by oil under pressure according to the principles laid down by Prof. Gümbel. The driving-gear is, therefore, contained in an absolutely oil-tight casing, the cylinders being separated by oil-and-water tight covers from the crank-case.

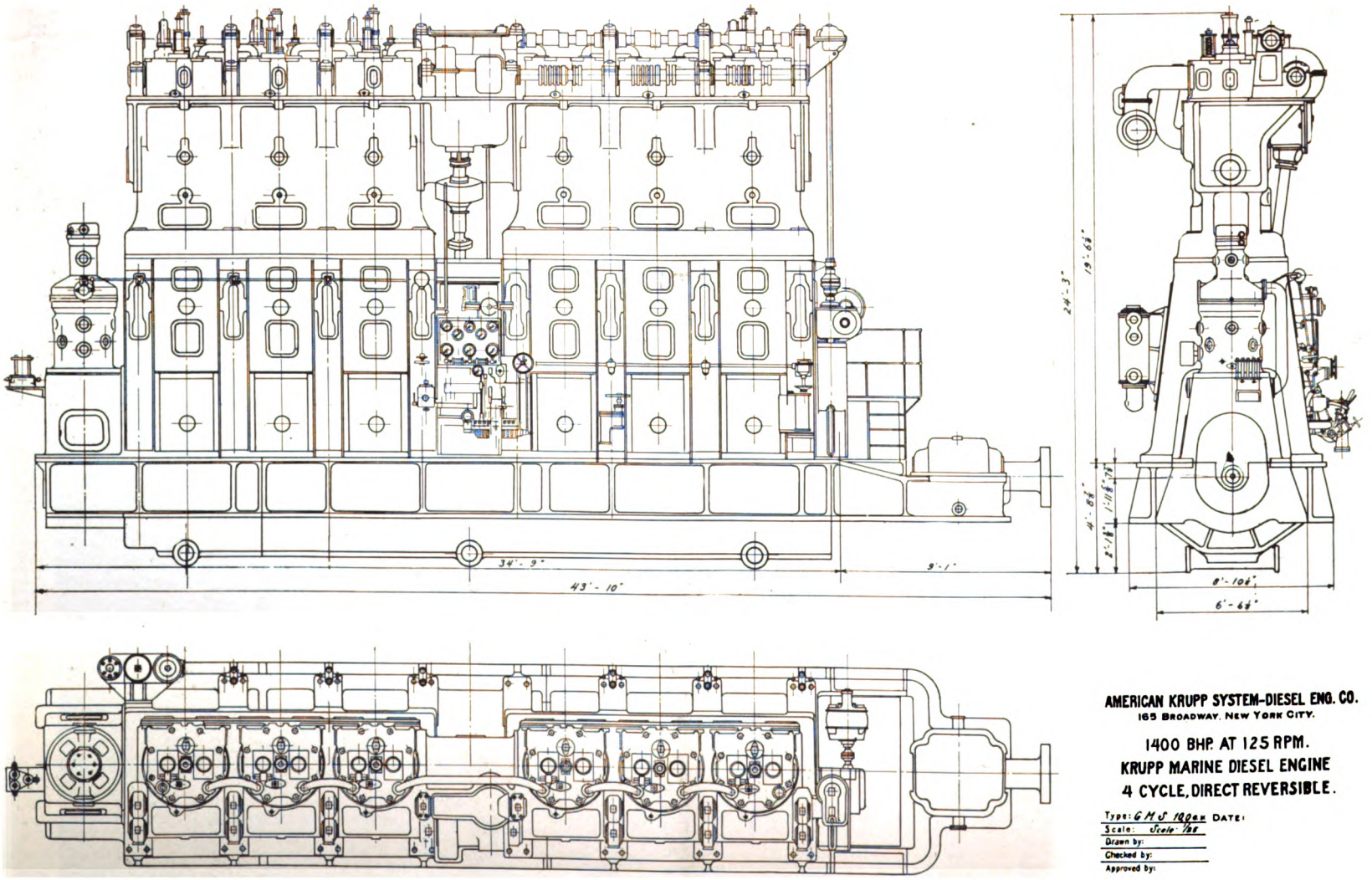
The entire engine is cooled by sea water, the pistons being cooled by telescope-tubes of Krupps non-rusting material. The water of the pistons has visible overflow into funnels situated at the back of the engine. In order to control the whole cooling water circulation small funnels are mounted on the front side of the engine into which the cooling-water from the control pipes of the crosshead-guides cylinder-covers, pistons and exhaust-valves visibly flows.

Acceptance Tests

On the 23rd of February, 1921, the acceptance tests in the presence of a representative of the firm which placed the order took place. No duration, but only guarantee output and fuel-consumption trials as well as ascertaining the working temperatures came into question, as in the present highly developed state of Diesel-motor construction at the Germaniawerft duration trials extending over many months would have been necessary to show up any constructional faults. Referring to the excellent experiences with the very successful motor-tankship "Zoppot," built and engined by the Germaniawerft which has been



Bedplate of Krupp Merchant-Marine Diesel Engine



General arrangement drawings of the Krupp Diesel Engine

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in uninterrupted service for about one year and a half without any trouble. Therefore, no trouble is to be expected with the four-cycle engine, as apart from other matters the specific load on the bearings is a great deal less than in the two-cycle engine of the "Zoppot." Duration trials on the test-bed would therefore only incur unnecessary expense for fuel, lubricating-oil and attendance without giving practical results.

The results of the acceptance trials are given in the attached table number one. The effective output was measured by a Froude water-brake built by the Germaniawerft.

During the trials on the test-bed a maximum output of 1,660 brake or about 2,300 indicated horse-power at 129 revolutions was attained. An over-load diagram with a mean indicated piston-pressure of about 130 lbs. per sq. in. is shown on page 100.

Merchant Motorship Installation

Another drawing shows the engine-room lay-out for a twin-screw motorship with two 1,400 shaft horse-power engines. It is here assumed that the lubricating, cooling-water and bilge-pumps have separate electrical drive, as also the other ship's auxiliaries such as the steering-engine, deck-winches, anchor-windlass, etc. The two Diesel-driven dynamo-sets provided for this purpose have each a capacity of about 100 kw., the Diesel-engines being of the latest Germaniawerft type especially built for continuous service. The two working-cylinders with their respective crank-chambers are cast together, the three-stage injection-air compressor has piston-valves in the lower and intermediate suction stages, the high-pressure valves are light steel disc-valves. The maximum revolutions are 300 per minute and can at sea be reduced to 200 per minute in order to conserve the engine.

Table I. 1400 B.H.P. merchant-vessel Diesel-engine acceptance trials, February 23, 1921.

Load	Time from to—	Fuel consumption. Kilos	Mean revs. per min.	Water brake load. Kilos	B. H. P.	Fuel consumption per B. H. P. hour. Grams.	Mean ind. piston pressure. Atmospheres	I. H. P.	B.H.P./ I. H. P.	Fuel consumption per I. H. P. hour. Grams.
Full load	11.00-11.30	293.5	125.0	2,600	1,550	189.5	7.7	2,130	72.8%	138.0
Three-fourths load	11.30-1.00	200	120.25	1,820	1,042	192.0	5.71	1,520	68.6%	131.5
One-half load	1.00-2.30	153.0	125.5	1,200	718	213.0	4.00	1,110	64.7%	137.8
No load	2.45-3.00	73.0	126.1	182	109	669.0	1.57	438	24.9%	166.5

Table II. 1400 B.H.P. merchant-vessel Diesel-engine acceptance trials, February 23, 1921.

Load	Time from to—	Fuel consumption. Kilos	Mean revs. per min.	B. H. P.	Analysis of the exhaust gases: CO_2 in %	CO in %	O_2 in %	N_2 in %	Air excess coefficient
Full load	11.00-11.30	293.5	125.0	1,550	10.2	0	7.6	82.2	1.58
Three-fourths load	11.30-1.00	200.0	120.25	1,042	8.5	0	10.0	81.5	1.94
One-half load	1.00-2.30	153.0	125.5	718	6.3	0	12.6	81.1	2.5
No load	2.45-3.00	73.0	126.1	109	3.1	0	16.8	80.1	5.0

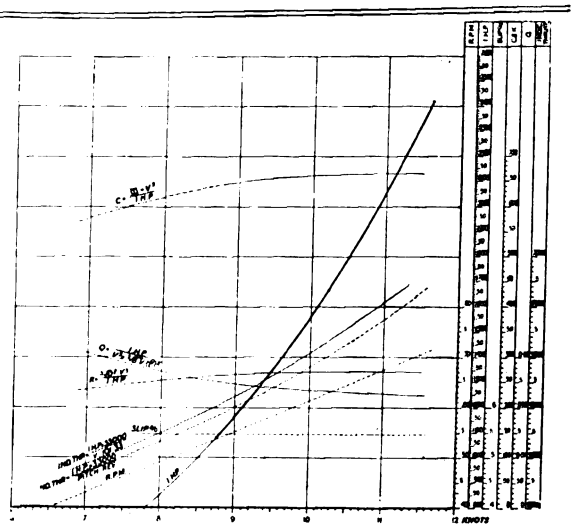
Two electrically-driven single-cylinder auxiliary air-compressor sets with a capacity of 250 cub. ft. of free-air per minute delivered at 900 lbs. per sq. inch are provided. In place of the two compressor-sets one compressor-set of 375 cu. ft. capacity may be chosen. The use of two smaller compressors, however, has the advantage that during ordinary manoeuvring for entering a harbor, as one 250 cub. ft. compressors-set suffices, which can be driven by a single Diesel-dynamo set, the second Diesel dynamo-set is in reserve. Before the war the Germaniawerft developed a special design for these auxiliary air-compressors, in order to be independent of outside designs, after having had some very unsatisfactory experiences with other makes. The lower and intermediate stages have piston suction-valves, the high-pressure stage light steel disc-valves.

The weight of the plant illustrated, consisting of two main-engines of 2,500 total shaft h.p. with fly-wheels, thrust-blocks and thrust-shafts, two Diesel-electric dynamo-sets of 100 kw. each, two electrically-driven air-compressor sets of 250 cub. ft. of free air per minute each, and one hot-bulb type of surface-ignition oil-engine for an emergency air-compressor and emergency dynamo-set of 9 kw., further the necessary tanks and pumps for the working of the equipment, as well as accessories and spare gear, is about 550 tons. The fuel-consumption of the complete plant is about 11.5 tons of oil-fuel per 24 hour day when working at full load, the lubricating-oil consumption being about 165 lbs. for the same period.

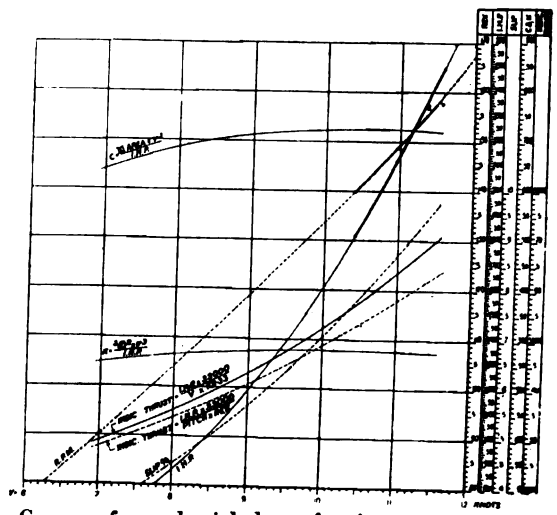
Results obtained.	Name of Ship.	Displacement in Tons.	Draught (Mean).	Speed in knots.	R.P.M. (Mean)	Speed Corr. for "Wake."	ρ	Propeller Efficiency.	Indicated horse-power.	Brake horse-power.	Tow-rope Resistance	Total Efficiency Propeller and Ship.
			Ft. In.									
Running over the measured mile.	*Suecia*	9,625	23 1½	11	149	9·45	15·76	0·629	2,140	1,710	1,150	0·672
	Prinsessan Ingeborg (ss.)	8,660	21 10	11	67·5	8–03	15·42	0 630	2,050	1,750	1,080	0·618
	Suecia	9.625	23 1¼	10·2	136·4	8·76	15·68	0·629	1,710	1,350	900	0·667
	Prinsessan Ingeborg (ss.)	8,660	21 10	10·2	62·5	7·45	15·43	0·630	1,650	1,400	855	0·610
Estimated	*Tongking Glass*	13,550	26 3	11·15	125	9·6	15·0	0·633	3,100	2,350	1,450	0·62
	Fionia	10,550	24 0	12·5	100	10·88	10·0	0·673	4,000	3,080	1,790	0·58
	Afrika	19,000	32 0	11·8	115	10·15	14·7	0·636	4,500	3,460	2,150	0·62
	Tienaren and *Bullaren*	—	—	12·0	100	10·31	11·55	0·658	4,000	3,080	—	—
	Ysgaren	—	—	12·0	77	9·1	16·68	0·621	—	3,000	—	—
	Leise Mærsk	6,350	22 0½	10·5	85	7·98	16·0	0·627	1,500	1,150	—	—
In open sea.	*Theodore Roosevelt**	14,960	28 11	11·58	133	9·95	14·9	0·634	3,331	2,550	1,610	0·631
	*George Washington**	13,550	26 5	11·83	129	10·18	13·92	0·641	3,298	2,540	1,710	0·674
	*George Washington**	13,550	26 5	11·5	129	8·89	14·7	0·636	3,213	2,470	1,560	0·631
	Fionia†	10,800	24 6	12·7	98·8	11·05	9·7	0·677	4,127	3,180	1,920	0·604

* 12 hours measured at sea. † Four days and nights measured at sea.

Table showing performance of motor and steamships. See pages 892 and 895 of our November issue. Delayed in mail



Curves of speed trial data of single-screw steamship "Prinsessan Ingeborg." See pages 892 and 895 of our November issue. Delayed in mail



Curves of speed trial data of twin-screw motorship "Suecia." See pages 892 and 895 of our November issue. Delayed in mail

BIG BUILT-UP CRANKSHAFTS

Two large crankshafts of the built-up type are being constructed by Armstrong, Whitworths for opposed-piston type Diesel marine engines building at Doxford's Sunderland plant, says "Engineering." Each will weigh 50 tons and will have 12 throws. The shaft is built up of four sets of cranks, each of three throws, for the opposed-piston working-cylinders, and one centre crank for the scavenge-pump. All are connected up by flanged coupling shafts. The total length of each complete shaft is 42 ft. 7.44 in. and a weight of 50 tons. The main journals are 16.93 in. in diameter. and the crank-pins are 18.11 in. in diameter. The main crank throw is 12.235 in. The first shaft to be finished, under inspection proved to be remarkably true and well within the limits of error allowed. The error in the total length was 0.008 in. and the maximum error in general alignment of all the journals did not exceed 0.0012 in. The average error in alignment of each separate length of journal in relation to general alignment was 0.002 in. and the average error in alignment of crank-pins in relation to general alignment of journals was 0.0003 in.

NORWEGIAN MOTORSHIP "BATAVIA"

The second of the two Burmeister & Wain trunk piston-engined 900 i.h.p. cargo motorships ordered by Fred. Olsen, Christiania, from A. P. Mollers Odense Yard, was launched last month and named "Batavia."

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Geared-Turbine or Diesel Power

Comparisons of Two New 7,500 Ton Ships in Service—"S. S. Atlanterhavet" and M. S. "Polarhavet"

SEVERAL years ago—as recounted in MOTORSHIP—order for two 7,500 ton geared-turbine ships were placed with the Southern Plant of the Copenhagen Dry Dock and Shipyard by the Atlanterhavet A/S (Atlantic Sea Ltd.) of Copenhagen, Denmark. But the owners afterwards decided to change one of the hulls to twin-screw Diesel-power and compare results of operations although this left the expensive turbine and boilers on their hands. Discussing this question with the marine-superintendent of a well-known Danish steamship company we were advised that no shipowner in that country will consider geared-turbines today, so much trouble having been experienced till now. It is practically assured that no more turbine cargo-vessels will be constructed in Denmark, all Danish operators being enthusiastic over the reliability and economy of Diesel power.

The turbine-steamer "Atlanterhavet" has been in service for some months and the Diesel-motorship "Polarhavet" ran he acceptance trials on December 7th last. Both vessels are of the same size and power, but the following differences are very noteworthy.

	Turbine-Steamer "Atlanterhavet"	Diesel-Motorship "Polarhavet"
Displacement (Loaded)	10,500*	10,585 tons
Deadweight Capacity	7,500 tons	7,500 tons
Daily Fuel — Consumption	23 tons	9½ tons
Daily Port — Consumption	10 tons* (about)	¾ ton
Length of Machinery —Space	43'6½"	41'3"
Weight of Machinery	458 tons	445 tons
Fuel Needed for 10,000 miles Voyage.	900 tons	365 tons
Water Needed for 10,000 miles Voyage	300 tons*	100 tons*
Engine & Boiler Room Crew — men		12 men

*MOTORSHIP'S estimate.

The weight of the turbines is 201 tons, boilers and water in same 232 tons, oil-firing apparatus 25 tons, tunnel and shaft 42 tons, or a total of 500 tons.

The weight of the Diesel-engines and Diesel-electric auxiliaries is 445 tons, the twin tunnels and shafts 74 tons, and the engine-stores, tools, spare-parts including extra propeller and shaft section, 23 tons, or a total of 542 tons.

While the actual weight of the motorship's engine-room machinery is lower and occupies less space, the total is really in favor of the steamer to the extent of 42 tons, as the particular Diesel-engines of the "Polarhavet" are not designed with any attempt at saving weight. But, against this is offset the fact that the steamer always has to carry three times the weight of fuel on any given voyage as well as three times the quantity of fresh water.

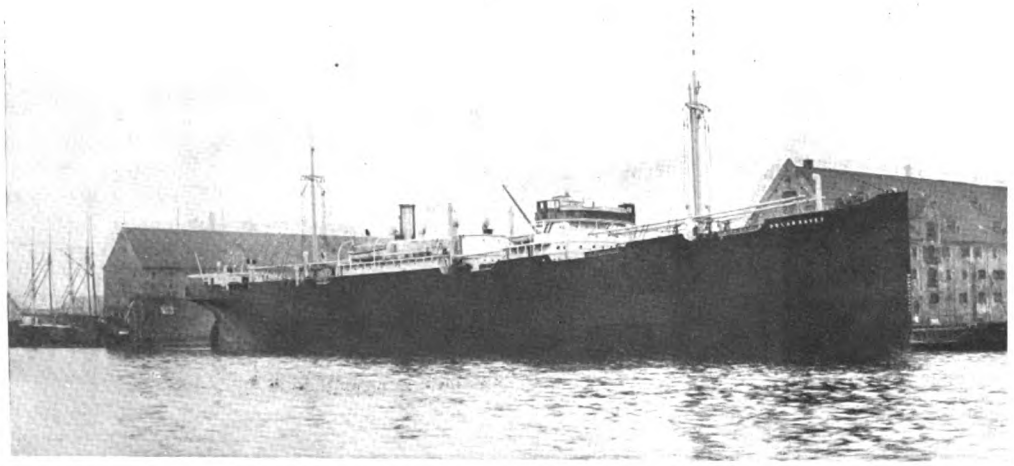
As the fuel and water are essential parts of the machinery it really means that the machinery-weight of the twin-screw Diesel motorship is at least 50% less than that of the single-screw turbine-ship, and the motor-vessel has a better propeller-efficiency over a long voyage under average weather conditions. The motorship actually can carry 400 tons more cargo than the turbine vessel.

To these facts we especially draw the attention of some of the engineers who recently read papers before engineering societies in New York in which they incorporate many misleading statements as previously discussed in MOTORSHIP.

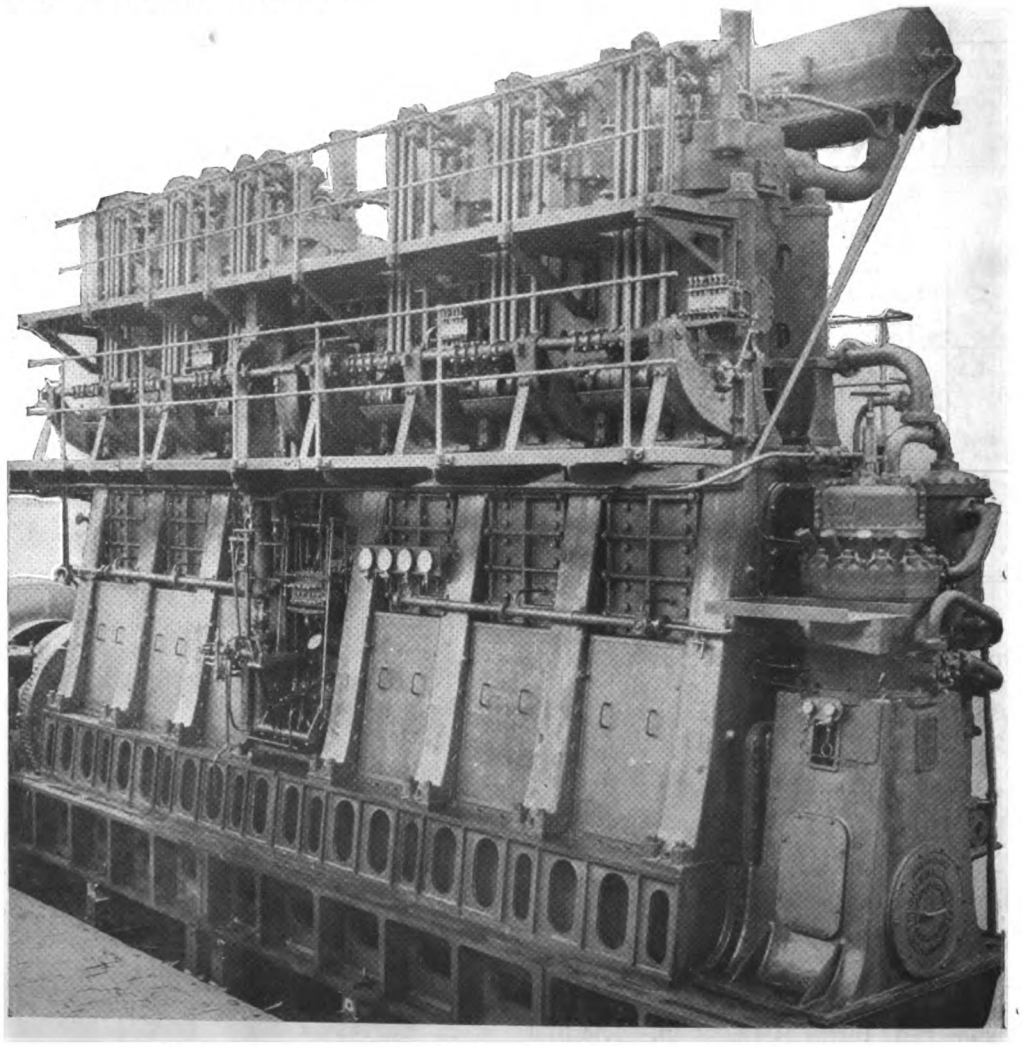
We take the opportunity to refer to what is seldom mentioned by naval-architects; namely, that in addition to the greater carrying-capacity of the motorship offsetting her higher cost, it is necessary to give a steamer higher power if she is to maintain the same average speed in service as a motorship of similar tonnage, because the steam pressure cannot be maintained level day after day and week after week, whereas the Diesel-engine revolutions are kept-up with clockwork precision. So to average the same speed as Diesel-engines of 2,200 shaft h.p., the steam-engines must be at least of 2,500 shaft h.p. at the same revolutions. This adds to the first cost of the steam machinery.

The motorship "Polarhavet" is fitted with two 1,400 indicated h.p. six-cylinder Burmeister & Wain Diesel-engines of the four-cycle type, and she has the following general dimensions:

Classed with	Bureau Veritas
Cubic Capacity of Holds	420,500 cu. ft. grain
Dead-weight Capacity	7,500 tons
Power	2,200 shaft H. P.
Length O. A.	389'9¾"
Length B. P.	375'0"
Breadth M. D.	52'0"
Depth to S. D.	35'0"
Depth to M. D.	27'6"
Mean Loaded Draft	24'6"
Guaranteed Speed	11 knots
Expected Average Loaded Speed	11¼ knots
Actual Average Speed on Trials	11.99 knots
Propellers (Twin)	11' dia. x 8'6" pitch & 35 sq. ft. area each
Engine and Propeller Speed	140 R.P.M.
Daily Fuel-Consumption	9.4 tons
Daily Port Consumption	¾ tons
Maximum Fuel-Capacity	1,041 tons



New B. & W. engined motorship "Polarhavet," built by the Copenhagen Dry Dock Co.



1,400 i.h.p. Burmeister & Wain Diesel engine of the motorship "Polarhavet"

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The engine-room crew consists of Chief-engineer, second and third engineers, four junior-asistants, four motormen and one electrician, or a total of 12 men.

During trials a thick fog prevailed. On the consumption test the engines developed 2,991.2 i.h.p., the port and starboard sets running at 147½ and 149¼ revolutions respectively, the consumption being 0.3175 lb. per i.h.p. hour.

On the speed test the engines developed 2,813 i.h.p. at 149¼ r.p.m., a speed of 11.99 knots being attained. Included in the fuel-consumption was the oil used by two of the three 75 b.h.p. auxiliary Diesel-driven 50 k.w. electric sets, the consumption working out at 144.03 grams per i.h.p. hour. The fuel readings were taken over a period of 3 hours during which time the engines ran maneuvering tests and the compressor adjusted.

There are 10 derricks, and 11 electric winches made by Thos. B. Thrige. A Hele-Shaw hydro-electric steering-gear and a Clark-Chapman electric windlass are fitted.

Two 1,000 Tons Deadweight Ships

Comparison of the Motorship "Virginia" with a Steamer of Similar Size

Among recent additions to the East Asiatic Company's motorship fleet is the steel 1,000 tons d.w.c. motorship "Virginia," which, with the exception of some 160 hp. 600 tons auxiliaries, is the smallest motorship owned by them. She was built at the Nakskov Shipyard, Nakskov, and engined by the Holeby Diesel Works, Holeby, Denmark. Recently she made her maiden voyage across the ocean to Trinidad, W. I., and St. Thomas, V. I. The main engine is a six-cylinder Holeby Diesel of 560 i.h.p. or 400 shaft h.p. at 200 r.p.m. of the trunk-piston, four-cycle type, driving a single screw. The cylinder bore is 14.57 in. by 22.44 in. piston stroke. In addition there are two 30 b.h.p. Holeby Deisel-engines driving 20 kw. electric-generators, and an 8 h.p. Holeby kerosene-engine driving an emergency compressor and ballast-pump.

Generally speaking it is not profitable to run steamships of this size on Transatlantic routes, but the low fuel-consumption with Diesel power often allows this to be done with motorships. We are enabled to compare the "Virginia" with a steamer of similar capacity tonnage.

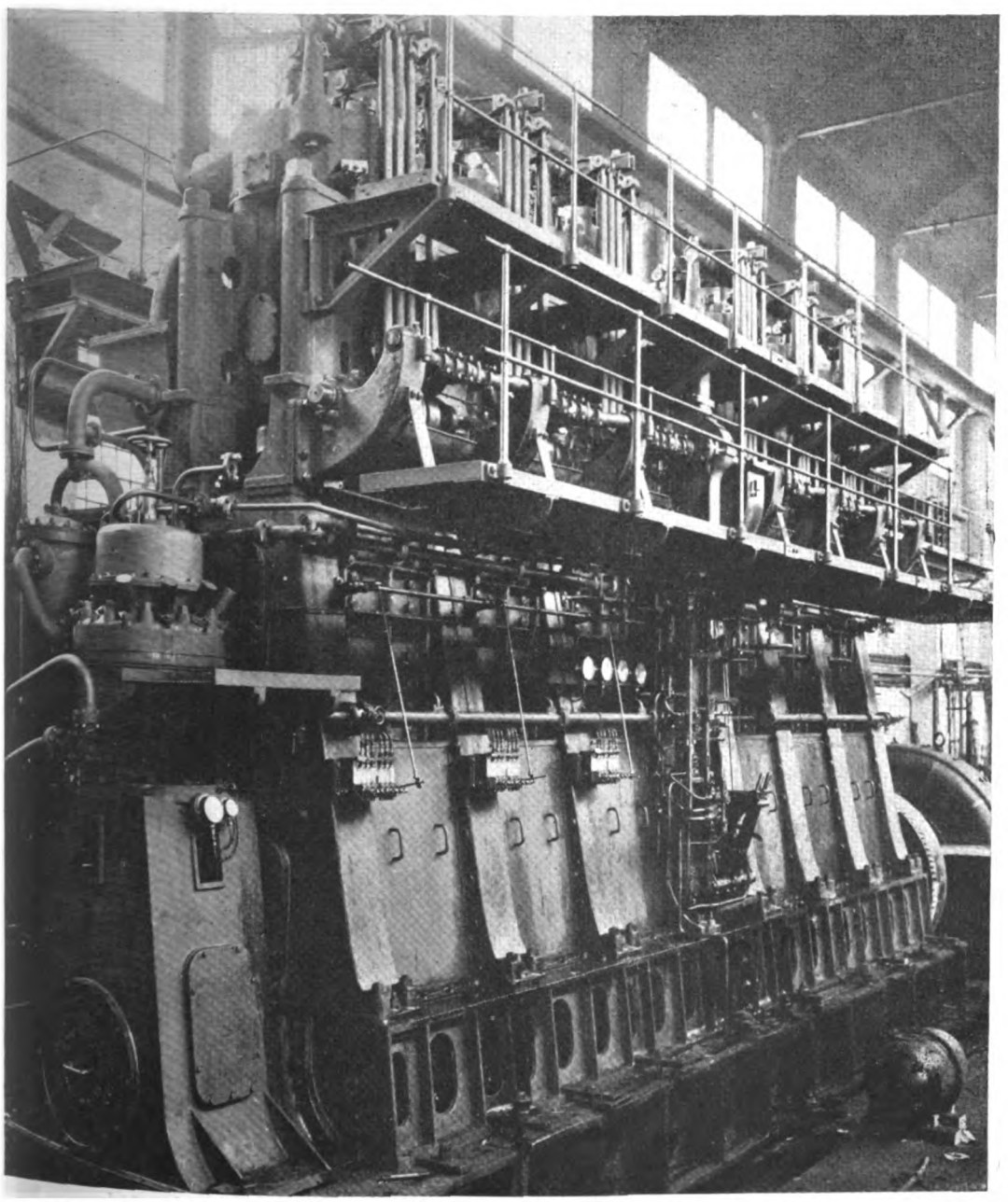
	Steamer	*Motorship*
Length	182'0"	170'0"
Breadth on frame	31'0"	31'0"
Depth to main deck	14'9"	14'3"
Weight of hull with equipment	417 tons	374 tons
Weight of machinery	140 "	80 "
Weight of bunkers	60 "	15 "
Weight of feed-water for boiler	8 "	0 "
Weight of fresh water (drinking, etc.)	6 "	6 "
Weight of crew, provisions and other items	10 "	10 "
Weight of cargo	969 "	969 "
Displacement (loaded)	1610 tons	1,454 tons
Gross Register	about 700 tons	650 tons
Speed	8.5 knots	8.5 knots
Engine horsepower	500 I.H.P.	400 B.H.P.
Consumption of coal & fuel-oil resp. 0.67 kg. per I.H.P. hour	0.2 kg. per B.H.P. hour	
Weekly Consumption	56.3 tons	13.4 tons
No. of engine crew	7*	4†

*Chief & 2nd mate, 1 assistant, 4 firemen.
†Chief & 2nd mate, 2 motormen.

While the motorship costs about 10% more than the steamer, she carries 10% more cargo, which balances the first cost. There is a saving of three men and the fuel-consumption is less than one-fourth. There is a saving of 60 tons in machinery and 53 tons of fuel and water, or a total of 113 tons in favor of Diesel power.

If the steamer were on a transatlantic voyage she would need over 200 tons of coal each way; whereas the motorship could make a round trip on less than 100 tons. However, we presume that the "Virginia" will remain in the West Indies district and not regularly cross the Atlantic. Her hold capacity is 41,800 cubic feet.

To handle the cargo there are three 3-ton electric-winches of Thrige design. The two hatches are 35 ft. 7½ in. by 15 ft. 11½ in. As regards the main engine, its crankshaft is solid-forged in two sections and is carried on eight bearings in a heavy bedplate. The cylinders are carried on cast-iron frames and have detachable heads and removable liners. Oil cooling has been adopted for the pistons, with salt-water cooling for the cylinders and heads. Forced lubrication is used, the crankshaft being drilled for this purpose. The valves are operated by push-rods from their respective cams, the camshaft being gear-driven from the crankshaft. There is one fuel-pump for each group of three cylinders, control being by hand, and by an Aspinall governor when the propeller lifts out of the water. The engine is built to British Lloyd's regulations.



One of the twin 1,300 i.h.p. Burmeister & Wain Diesel Engines of the Rotterdam Lloyd's motorship "Kedoe"

NO CABLE MOTORSHIP FOR DANISH COMPANY

The report that the Det Store Nordiske Telegraf-Selskab of Copenhagen has invited tenders for a twin-screw cable-laying motorship is incorrect, according to advice received direct from the company.

MOTORSHIP'S 6,527 MILES NON-STOP RUN

In all kinds of weather the new 9,000 tons d.w. motorship "Lobos" made a non-stop run of both Diesel engines and ship of 6,527 nautical-miles from Liverpool to Bahia Blanca from October 26th to November 20th last. She is owned by the Pacific Steam Navigation Co. and fitted wih Harland & Wolff B. & W. motors.

LAUNCH OF 10,000 TONS MOTORSHIP "TENERIFFA"

"Teneriffa," the first of the three Diesel-driven 10,000 tons d.w.c. motorships building for Wilh. Wilhelmsen of Tonsberg, Norway, at Burmeister & Wain's yard, Copenhagen, Denmark, was launched on December 15th last. Two 1,550 B. & W. Diesel-engines are being installed at their Refshale Island plant.

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REVISION OF SHIP'S TONNAGE-MEASUREMENT NEEDED

WITH some motorships all the space gained by use of Diesel machinery has not been utilized with advantage, resulting in some engine-rooms being longer than necessary, and in the case of freighters, valuable cargo-space is thereby lost, apparently the reason is that if all the available space were utilized the cubic-capacity of the engine-room would be less than 13 per cent of the total cubic-capacity of the ship and would not be deductible from the tonnage subject to harbor and canal dues. This occurred in the case of the Rotterdam Lloyd's new motorship "Kedoe," which has an engine-room larger than her engines demand.

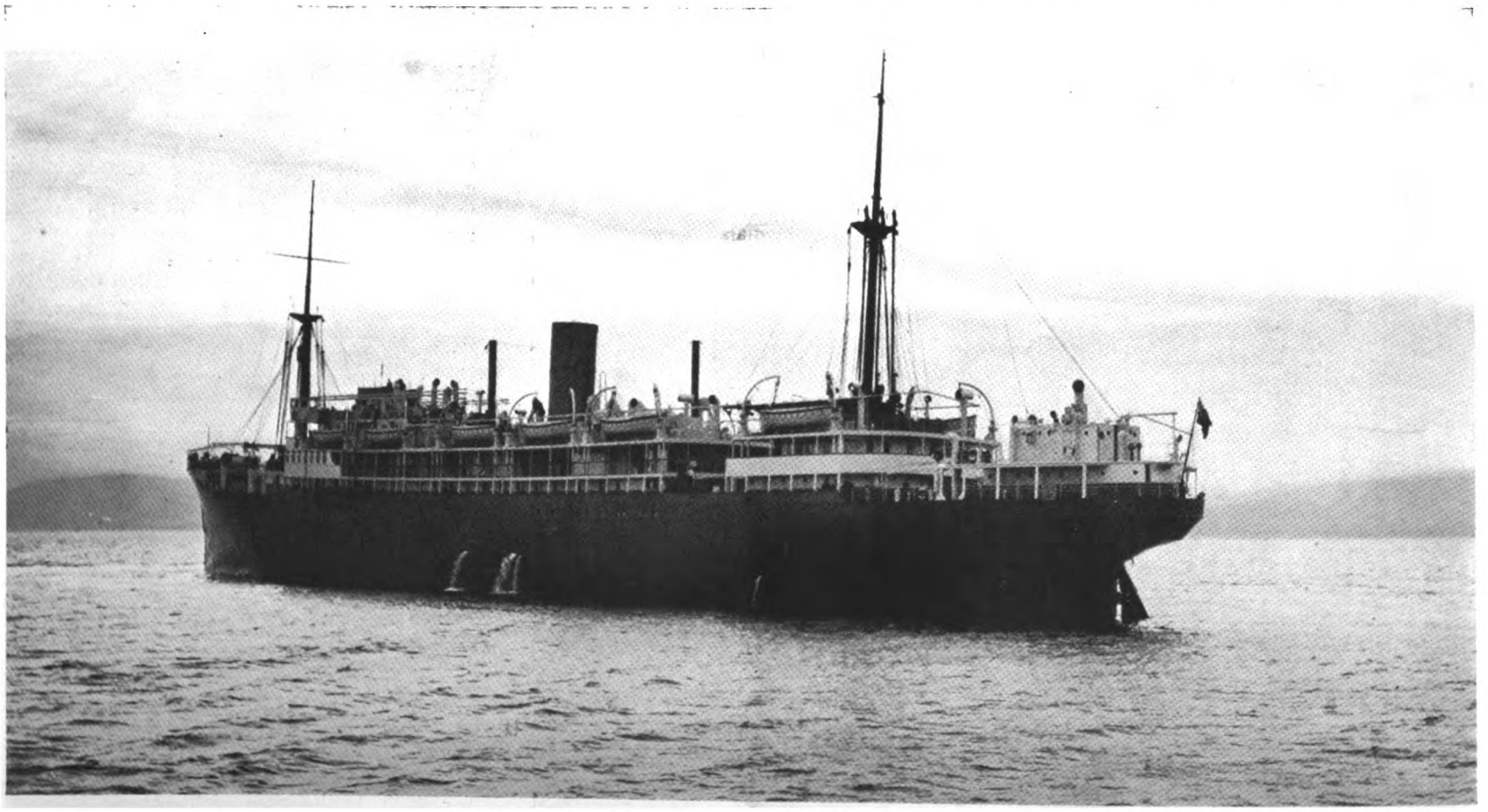
To our mind, if this method of reasoning is sound, a ship should be all engine-room and have no under-deck cargo space, with the object of avoiding dues, which—according to Euclid—is absurd. So surely it is better to be able to carry a greater bulk of cargo, because the tax on the space is only a small percentage of its earning value. Possibly shipowners have in mind that in these days of scarcity of freight, the vessel for the most part will be only partly loaded, while the dues have to be paid upon her registered measurement, and not on the tonnage carried at any particular time. In one sense this would be reasonable if a vessel was built for to-day's uncertain ocean business and not also to handle the trade prosperity of years to come. But, a more logical plan would be to build the hull ten or twelve per cent smaller than a given steamship and so reduce the first cost, overhead charges, running expenses and dues without any reduction of the cargo-space. In this way both present and future conditions of the freight market will be met in the most economical method possible. Meanwhile shipowners should agitate for an official revision of existing methods of ship-measurement, which have been made antiquated by the era of the modern oil-engine motor-vessel.

INTENSIVE PUBLICITY AND ITS PSYCHOLOGICAL EFFECT

HOW many executives understand the true value of that form of commercial publicity known as advertising, and that it has a much broader aspect than the mere buying of space in magazines solely for the purpose of producing enquiries and orders? Advertising is always educational and performs a most valuable function in the progress of the world, so no editor need ever feel embarrassed when discussing the subject in the editorial pages. This particularly applies to the question of the relation of commercial-publicity in as far as the motorshipping and allied industries are concerned. It is the co-ordination of the Diesel-engine building interests and the intensification of advertising, combined with editorial effort that is doing so much to induce shipowners to build new Diesel-engined motor-ships, to hasten the conversion of existing uneconomical steamships, and to cause Governmental action.

While individual advertising may not always bring about direct results during dull times, the combined results of a large number of advertisements produce the necessary atmosphere and have their psychological effect, so that each individual advertiser ultimately benefits by the reaction in the form of stimulation of buying, and some of the advertisers immediately benefit. The company that "falsely economises" by almost eliminating publicity appropriations is liable to be left out in the cold, because the purchaser naturally will go to the concern with which he is more familiar, and whose prestige is maintained after its establishment. The public has a short memory.

In no other industry is advertising more important than in the field covered by MOTORSHIP, as a continuous educational campaign must be maintained in order to create a remunerative market, this being a growing business. There can be no doubt but that the editorial work accomplished by MOTORSHIP assisted by its educational advertising pages has actually produced millions of dollars worth of orders that otherwise would never have existed, but would have gone to steam-engine and boiler builders, and these have paved the way for far more extensive business. But it is easy to imagine how little influence MOTORSHIP would have on the opinions and decisions of shipowners, no matter how excellent its editorial pages were, if unsupported by a substantial volume of the advertising of responsible



NEEDED TO BALANCE AMERICA'S MERCHANT FLEET

The British Diesel-driven passenger-cargo liner "ABA," a type of ship against which no American vessel afloat can compete. She makes 13½ to 14 knots on less than 24 tons of fuel-oil per 24-hour day, and carries 360 passengers. Similar ships are urgently needed in America

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companies. The moral and psychological effect of the matter is very powerful, as it represents the beliefs and confidence of many of the world's finest marine-engineers, and the views of firms who are valuable assets to the nation's business, which must necessarily weigh heavily with less technical shipowners.

MOTOR PASSENGER LINERS FOR BERMUDA SERVICE

ON another part of this page are published complete details of a fine Diesel-driven passenger-vessel, which compared with a sister steamer, is remarkably economical. It is time that two of such motorships were constructed in America and placed in service on the New York-Bermuda route, which at the present time is solely in the hands of British steamship companies, it not being possible for American steamers to compete because of the much lower operating-costs of the British vessels. However, the economy derived by the use of Diesel power, would enable American shipowners to receive the percentage of this traffic to which they are justly entitled, a large percentage of the passengers to that beautiful isle being American citizens.

A Motor-Driven Passenger Liner

More Details About the Re-Conditioned Elder-Dempster Combination Passenger and Freight Carrier "Aba"

AT the time the motorship "Aba" ex-"Glenapp" was completed she was the highest powered and fastest Diesel-driven ship afloat, and next to the Krupp-built motor-tanker "Zoppot" ex "Wilhelm A. Reidemann" was the world's largest motorship. She is also noteworthy for being one of the few oil-engined vessels that the British Government permitted construction of during the war. It may be recalled that when she was placed in service illustrations and details appeared exclusively in "Motorship," not even the British journals being allowed to publish pictures. In our issue of December last we showed her as she now appears since her conversion to a splendidly-equipped motor passenger-vessel. Her re-conditioning was carried out by Harland & Wolff for the Elder Dempster Company, who purchased her from the Glen Line (or from the British Government). Originally she was laid down for the East Asiatic Company of Copenhagen, who were not allowed to take possession because of the war regulations.

By reason of the small quantity of fuel necessary to carry this big ship from Liverpool to West Africa and return, namely 700 tons of oil in double-bottoms, compared with 3,000 tons of coal or 2,200 tons of oil if steam-propelled, her holds are left free for about 9,000 tons of cargo. As a matter of fact it is obvious that carrying such a large quantity of coal would not be practical, so a steamship would have to call at one or more coaling ports en route and bunker at the highest price, apart from the value of the lost time. For a vessel of her size the same would almost apply if she had oil-fired boilers, as 2,200 tons of fuel-oil would infringe heavily on her cargo capacity and reduce her earning power.

We understand that she carries about 9,000 tons of cargo and 365 passengers at 12½ to 13½ knots average speed on a daily fuel-consumption of about 24 tons of oil. This with 6,400 i.h.p. at 120 r.p.m. Vessels of this type, but with a little more power and speed, are highly desirable for balancing the American merchant-marine. At present we have no ship that could compete with this vessel. In fact the owners of the "Aba" have just secured a contract from the Vacuum Oil Company to carry 750,000 cases of oil from New York to West Africa in the face of competition from American steamship owners.

The leading dimensions of the "Aba" we will repeat as follows:

Length O. A.	470 ft. 0 in.
Length	450 ft. 5 in.
Breadth	55 ft. 8 in.
Gross tonnage	8,000 tons
Passenger Accommodation,	225 first and 140 second and third class
Power	6,400 i.h.p.
Speed	12½ to 13½ knots
Daily Fuel-Consumption	22 to 24 tons

Her main propelling-machinery consists of a pair of eight-cylinder Diesel-engines working on the four-cycle principle, and constructed by Harland & Wolff, Ltd., Glasgow, from Burmeister & Wain design. Each of the 16 cylinders has a diameter of 750 mm. (29.527 in.) by 1,100 mm. (43.307 in.) stroke, and when running at a speed of 120 revolutions per minute a brake horse-power of 4,800 is developed, or 6,400 indicated horse-power. This figure, representing the largest power up to the present time installed in any Diesel-engined vessel, the Glen Line ships of the "Glenogle" and new "Glenapp" class being of 6,000 i.h.p. but other ships in service have Diesel engines with greater cylinder power; in fact nearly double in one instance. The maneuvering-air pressure is approximately 350 lbs. per square-inch, and the blast-air pressure approximately 850 lbs.

The electric-power installation for the auxiliaries on deck and in the engine-room comprises three sets of four-cylinder Diesel-engine generating-plants, each of 200 kilowatt capacity. All the auxiliary machinery is electrically driven, this including the maneuvering air-compressor, refrigerating machine, all service-pumps, cargo-winches, windlass, steering-gear, etc.

In addition, the heating and cooking installations are electrically operated, and quite a large number of electrically-driven ventilating fans are installed. In view of the large number of passengers and crew to be catered for, the use of electrical cooking devices, as well as the accommodation heating arrangements, is noteworthy, but not original, as they are adopted on the British India Steam Navigation Company's new motor-passenger-liners, including the "Domala," and on several smaller Diesel-engined vessels.

The hull is divided by seven watertight bulkheads into eight compartments, and has a double-bottom extending right fore and aft. Two forward tanks are adapted for carrying fresh-water, and the remainder of the double-bottom except the portion under the engines is arranged to carry either oil-fuel or water-ballast. Under the engines the space is divided into three compartments, the centre being adapted for lubricating-oil and the wings for piston-cooling water, fresh water being used for the latter purpose. Oil-fuel is also carried in tanks built between the shaft tunnels. The fore and after peaks are fitted for the carriage of fresh-water.

The first-class dining saloon is situated on the main-deck forward and extends the full width of the vessel having a well above which extends to the shelter-deck. The paneling is in white with gilt enrichments and Wedgwood placques, whilst the furniture is of oak. The seating accommodation provides for 220 persons, and the saloon is exceptionally well lighted, the sidelights being 14 in. in diameter.

The first-class lounge on the bridge-deck at the fore end is framed and panelled in sycamore relieved by carving. A handsome fireplace is fitted containing a "Majicoal" electric fire and in the overmantel is an oil painting entitled "The Bay of Naples," a clock being fitted in the panelling immediately above. The furniture consists of wicker chairs and settees with loose cushion covers in blue and fawn tapestry. A piano is also provided.

The reading-and-writing room is situated on the bridge-deck immediately aft of the forward entrances and stairway. The panelling is painted gray with gilt enrichments, and the room is lighted by large teak-framed windows provided with rose colored curtains. Wicker chairs and settees with loose cushions covered with silver and chintz tapestry are provided, together with oval wicker tables, mahogany writing tables and a bookcase of the same material.

On the bridge-deck immediately forward of the after entrance is situated the first-class smoke-room. This room is panelled in oak with a white cornice and ceiling. A handsome fireplace is arranged at the fore end, containing an electric fire, and in the overmantel there is a painted tapestry panel depicting an Elizabethan hunting scene. Large teak-framed windows admit plenty of light, and the oak furniture harmonizes well with the general decorative effect. An open verandah has been provided at the after end of the bridge deck and is fitted up with teak tables and chairs.

Both the first-class entrances are on the bridge deck. The forward stair extends down to the first-class dining-saloon on the main deck, and is fitted with a wrought-iron balustrade with gilt ornaments and a mahogany handrail. The companion and entrances are panelled with mahogany dado and the walls and ceiling are painted white. Over the entrance-hall on the bridge-deck is a decorative dome of amber-tinted glass. The after entrance and stairway have been decorated in a similar manner; in this case the stair extends to the shelter deck. On the bridge-deck amidships two suites have been provided consisting of sitting, bed, and bath rooms. The bedrooms are panelled and painted white, with furniture of natural sycamore. One sitting-room is panelled in mahogany with furniture to match, and the other is in oak.

The first-class staterooms are located amidships on the upper and shelter decks, and the feature is that natural light direct from outside is supplied to each. The majority of the staterooms have three berths each, but a few single-berth rooms are provided on the shelter-deck with cot-beds. The furniture generally is of polished mahogany, and the floors are laid with plain linoleum and rugs.

The second-class accommodation is also of a thoroughly up-to-date character. The dining saloon, capable of seating 124 persons, is on the upper deck aft of motor casing, and extends the full width of the vessel; it is panelled, and the walls and ceiling are painted white, while the furniture is of mahogany.

The name of the company owning this fine ship, is the British & African Steam Navigation Co., Ltd., for which Elder Dempster & Co. are managers.

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Fleet of Motorships to Be Built in America

Six Combination Cargo-Passenger Diesel-Driven Vessels for Boston-Halifax Service

Throughout shipping circles oil-engines and motorships are "in the atmosphere" as it were, most of the leading Diesel-engine builders having received numerous serious enquiries during the past few months, many of which are very likely to turn into tangible orders, before long, including the five 240 b.h.p. vessels for the New York State Canal. As we close for press bids are due to be opened for six combination cargo and passenger vessels of 13 knots speed for Boston-Halifax service of a New York steamship company whose name we have been requested not to publish.

Designs and specifications for these vessels have been prepared by the well-known New York naval-architects, Whittelsey & Whittelsey, and five shipyards were expected to bid; namely:

(1) Newport News Shipbuilding & Dry Dock Co., Newport News, Va.

(2) Standard Shipbuilding Corp., Shooters Island, N. Y.

(3) Staten Island Shipbuilding Co., Staten Island, N. Y.

(4) Sun Shipbuilding Company, Chester, Pa.

(5) Merchants Shipbuilding Corp., Chester, Pa.

It is interesting to note that the owners and designers are not considering steam propulsion—either oil-fired or coal-burning—in their specifications, Diesel-drive of the slow-speed type being stipulated, and in connection with the machinery equipment of these vessels the architects have associated with the well-known Diesel expert Hy. Schreck, who our readers may remember edited MOTORSHIP's Patent Record section. The owners of these vessels while at present operating steamers, have recognized that the most profitable class of vessel under to-day's conditions is the Diesel-driven motorship. The new craft are to have the following dimensions:

Length B. P. ..... 225 ft. 0 in.
Breadth ..... 34 ft. 0 in.
Draught ..... 15 ft. 0 in.
Power ..... 1,500 shaft. h.p.
Speed ..... about 13 knots

Builders were required to submit quotations on the basis of:

(A) Diesel-drive with Diesel-electric Auxiliaries.

(B) Diesel-drive with Donkey-Boiler & Steam Auxiliaries.

Specifications state that domestic-built Diesel-engines are preferred, but that foreign-constructed engines will be considered provided they are constructed in a well-known plant experienced in this class of work.

AMERICAN MOTORSHIP'S VOYAGE AROUND THE WORLD

The Shipping Board's motorship "William Penn" operated by the Barber Line, left Singapore for Port Said on January 6th. She will soon return to New York.

ANOTHER SUBMARINE-CHASER CONVERTED

Along the same lines as the oil-engine installation in the converted sub-chaser "Corona," illustrated in our issue of November last, there is now being carried out in the Bahama Islands the installation of two 60 h.p. Fairbanks, Morse oil-engines in one of these former U. S. Navy craft.

TRIALS OF MOTORSHIP "DOMINION MILLER"

Trials were scheduled to take place of the Doxford Diesel-engine single-screw motorship "Dominion Miller" ex-"Eknaren" towards the end of January. Seven days shop trials have been run on 0.94 Mexican fuel-oil with highly satisfactory results. Details of these trials will shortly appear in "Motorship." The owners are Messrs. Furness-Withy & Co.

WILH. WILHELMSEN'S THREE MOTORSHIPS

We understand that the first of the three 9,500 tons deadweight motorships for Wilh. Wilhelmsen of Tonsberg has been launched by Burmeister & Wain.

Length ..... 425 ft. 0 in.
Breadth ..... 55 ft. 0 in.
Depth ..... 30 ft. 6 in.
Draft ..... 26 ft. 5 in.
Power (B. & W. Diesels) ..... 3,100 i.h.p.
Speed ..... 11½ knots

Three of the 8,000 tons A.E.G.—B. & W. Diesel motorships building at the Deutsche Werft, Hamburg, are to Mr. Wilhelmsen's order.

New motorship "Arator" of the Swedish Farmers' Shipping Co. leaving Burmeister & Wain's yard for trials

MOTORSHIP "DOMALA" AVERAGES 13¾ KNOTS ON TRIALS

Trials were recently run by Barclay, Curle & Co. of the new motorship "Domala," ex "Magvana," of the British India Steam Navigation Line, and a speed of 13¾ knots was averaged, her twin North British Diesel-engines developing 5,200 I.H.P. Following the measured-mile trials an endurance test of 48 hours at 13¼ knots was carried out with highly satisfactory results, both as regards economy and reliability, the engines running throughout the whole test with absolute smoothness and regularity.

The "Domala" is of 10,500 tons deadweight, and carries 100 first-class and 40 second-class passengers in addition to cargo. She is a type of vessel of which a number are required to balance the American merchant fleet, although our ships should be able to maintain 15 to 16 knots in service. The "Domala" has been described and illustrated in MOTORSHIP.

JULY, 1919, COPY OF "MOTORSHIP" WANTED

Gasmotorenfabriek Deutz, Heerengracht 134, Amsterdam, Holland, desire to obtain a copy of MOTORSHIP for July, 1919, which we cannot furnish. We would appreciate it if any reader who can spare such a copy would mail same direct to the above firm.

ADDRESS OF FALK CORP.'S FRENCH REPRESENTATIVE

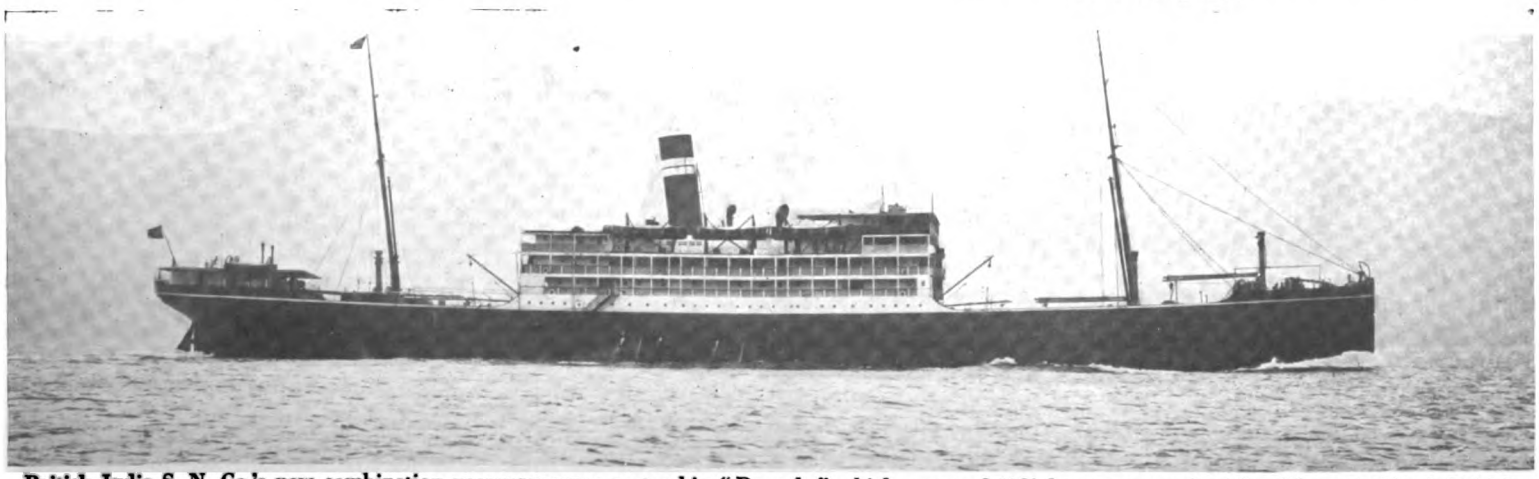
In the advertisement of the Falk Corporation of Milwaukee, Wis., page 62 of the January, 1922, issue of MOTORSHIP, the address of their foreign representative, namely, Gustav Melms, was given as 8 Rue Taitbout, Paris. This should be 3 Rue Taitbout.

PNEUMERCATOR CO., INC., MOVES

The Pneumercator Co., Inc., manufacturers of gauges for measuring liquids and ships' drafts, with general offices in New York and factory in Philadelphia will move both offices and factory Feb. 1, 1922, to the Sperry Building, 40 Flatbush Ave., Brooklyn, N. Y.

AGED FATHER ANXIOUS TO HEAR OF SON

Will Mr. A. E. Russell, who was believed to be in the employ of the Diesel Gas Engine Co. of Newport, R. I., in 1913-14, write to his aged father, R. G. Russell, of Chandler, Ariz., who is very anxious to hear from him? The last time Mr. Russell heard from his son was November, 1914, when he was advised that he expected to go to South America selling Diesel-engines.



British India S. N. Co.'s new combination passenger-cargo motorship "Domala," which averaged 13¾ knots on speed trials. Her twin North British Diesel-engines averaged 5,200 i.h.p.

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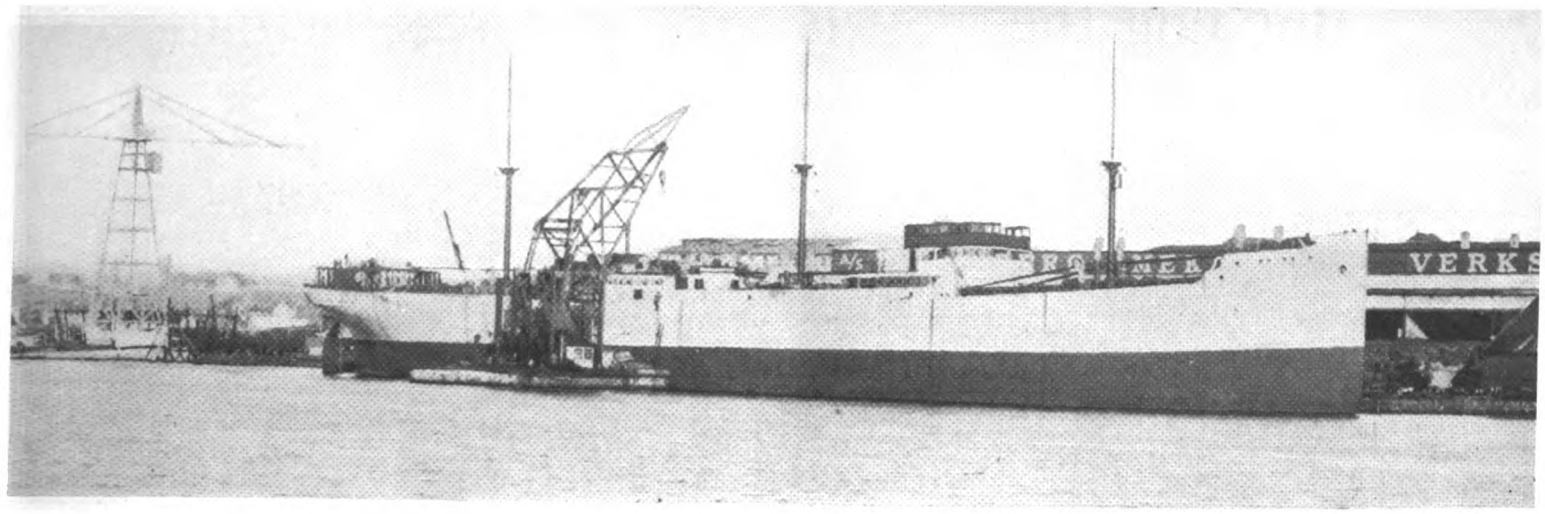


Norway's Largest Merchant Ship

New Sulzer-Diesel Driven, 9,000 Tons Deadweight, Freighter "HANDICAP" Trials—Has No Donkey-Boiler Fitted

WHEN in Europe in 1919 we had the pleasure of visiting the plant of the Thunes Mek Verksted, of Kristiania, Norway, who at the time had recently undertaken the construction of Sulzer two-cycle Diesel engines under license, and were then engaged in the building of submarine engines for the Norwegian navy. They were and still are associated with Rosenburg shipyard at Buisland, near Stavanager, both concerns being controlled by the Norwegian Engineering Industries, Ltd. At the time we sent an article dealing with this development to our office in New York, which manuscript apparently went astray in the mail, an occurrence frequent in those days.

Trials were run early in December last of the first large motorship built at the Rosenburg yard, namely the "Handicap," owned by Bruusgaard, Kiosterud & Co., of Drammen, who for some years have owned and operated the big Polar-Diesel engined tanker, "Hamlet," which craft is a frequent visitor to New York harbor. The "Handicap" is one of the very few large motorships to be completed without having a donkey-boiler installed, all the heating and cooking being carried out by electricity, as well as all the auxiliary machinery both on deck and in the engine-room. Furthermore, she is the largest merchant-ship yet constructed in Norway. Consequently it is worth recalling that the largest vessels completed in Sweden and Denmark are also Diesel driven, but have four-cycle engines.

Although the Thunes works are licensees of the Sulzer Company in Winterthur, Switzerland, the twin 1,350 shaft horsepower Sulzer two-cycle Diesel engines were not built in Kristiania, but by the licensors. These sets make a total of 22,000 B.H.P. in Sulzer marine Diesels delivered to Scandinavian countries by Sulzer Freres. Originally the "Handicap" was commenced as a turbine ship, but the firm that ordered her could not meet their financial obligations, so the builders sold the hull to her present owners who decided to have the vessel finished as a more economical motorship. Her leading dimensions are as follows:

Length B.P.	415 ft. 0 in.
Breadth	54 ft. 6 in.
Depth	36 ft. 11 in.
Draft (Summer freeboard)	24 ft. 8 in.
Deadweight Capacity	9,000 tons
Fuel and Ballast water Capacity	1,350 tons
Shaft horsepower	2,700 h.p.
Indicated horsepower	3,600 h.p.
Engine speed	100 r.p.m.
Ship's speed	11½ knots

Drawings of this ship were reproduced in "Motorship" several months ago. Her twin main-engines have four cylinders each, 23.622" bore by 41.732" stroke, and drive Zeiss bronze propellers made in Germany through steel shafts 116½ feet long. For auxiliary power she has two Sulzer Diesel engines of 330 b.h.p. each, and both of these drive 220-K.W. 220-volt electric-generators, one set being a stand-by under average conditions. These generators also provide current for the motors that operate turbo-blowers used for scavenging the working-cylinders of the two main-engines, this equipment taking the place of the usual scavenging-pumps.

The "Handicap" has been built as a twin-screw, three-masted shelterdecker cargo-vessel with short superstructures, and is equipped with eight watertight bulkheads, a large deep-tank midship forward of the engine-room, six hatches, 12 electric-driven 3 and 5 tons winches; electric windlass, a Hele Shaw hydraulic-electric steering-gear; and the Lux fire-extinguisher system, there being no steam. The double-bottom extends over the whole length of the vessel and is divided up in eight water- and oil-tight tanks. Both the main and auxiliary engines are of Sulzer's two-cycle system with sea-water cooling throughout. The thrust-bearings have forced-fed lubrication, and are provided with one pressure-ring only, and are built into the bedplate of the main engines.

The auxiliary engines are fitted with automatic governors, controling simultaneously the fuel-oil, the timing of the fuel-injection and the pressure of the blast-air. This assists perfect combustion, even at great variations of loads, without any hand adjustment.

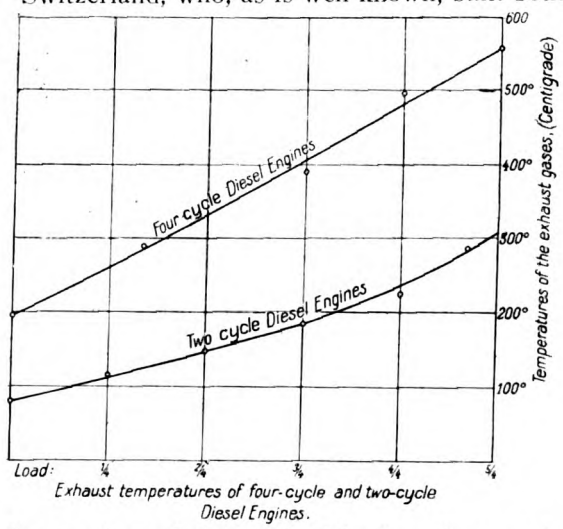
Besides the water-oil- and bilge pumps that are driven direct by the main and auxiliary engines, the auxiliary machinery comprises six electric driven aggregates:

1 ballast-centrifugal pump, combined with a vacuum piston-pump.
1 bilge-centrifugal pump, combined with a vacuum piston-pump.
1 sanitary and fire centrifugal pump for a pressure height of 100 meters.
1 fresh water centrifugal pump.
1 fuel duplex centrifugal pump.
1 refrigerator set.
3 air-driven duplex-pumps for fuel and lubricating oil.

In a recess in the aft bulkhead, level with the main deck, is the workshop, next to which a 12 h.p. hot-bulb oil-engine is installed and clutched direct to a high-pressure air-compressor and an 8-kilowatt electric generator. The daily fuel service-tanks and tanks for the lubrication-oil for the bearings are arranged on the front bulkhead. Here also are to be found the switchboard, and on each side of the latter four air-bottles. These eight starting and maneuvering-air bottles have only about 6 cu.m. capacity, which suffices for the Sulzer engines, as their starting-air pressure can be varied within big limits, and the air thus be utilized to a high degree of efficiency.

EXHAUST TEMPERATURES

It is not yet generally known that the temperature of the exhaust gases in a two-cycle engine is much lower than in a four-cycle engine. The exhaust temperatures of larger four and two-cycle engines are shown in the accompanying diagram as functions of the load. These results were obtained from engines constructed by Sulzer Freres. of Winterthur, Switzerland, who, as is well known, built both



Exhaust temperatures of four-cycle and two-cycle Diesel Engines.

four-cycle and two-cycle Diesel engines, and have therefore learned to appreciate the advantages and disadvantages of both systems. The temperatures of the exhaust-gases from the two-cycle engine are, according to the load, about 120 to 150 deg. C. lower than those from a four-cycle engine. With a temperature of about 300 deg. at overload, they are still within the practical limits of working. The exhaust-piping of a large two-cycle engine has therefore not to stand as high temperatures as those in the main steam-pipe of a steam engine.

SULZER ENGINES OF THE "CAMRANH"

In our issue of November last, page 887, there was given a description of the French motorship "Camranh." It was stated that each of the twin Sulzer-Diesel engines of this vessel developed 1,700 shaft h.p. at about 100 r.p.m. However, these engines develop the power in question when running at 80 r.p.m.

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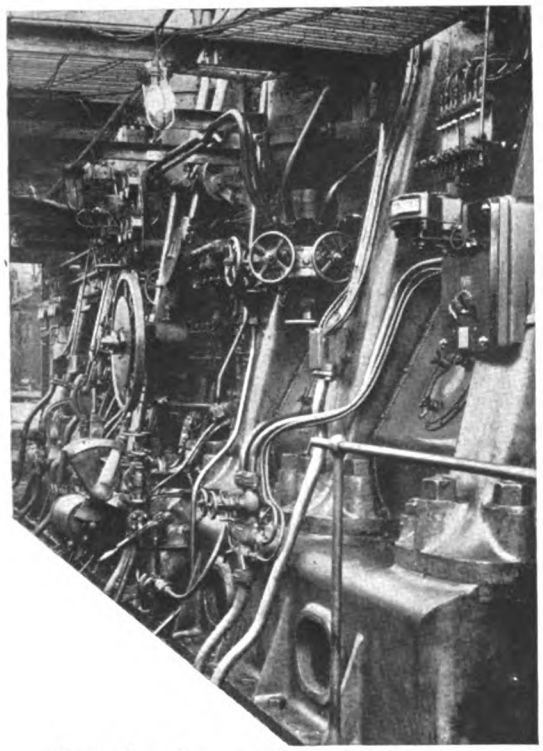
Building the Tosi Engine in Great Britain

Diesel Motors of the New Fruit-Carriers "PINZON" and "PIZARO"

ANY development of the Tosi Diesel marine-engine automatically becomes of interest to this country, as no fewer than three American engineering and shipbuilding concerns own rights to construct to this well-known Italian design. It is regrettable that there are no American Tosi-engined vessels in service, especially as any well-informed engineer will acknowledge that the design has much to commend it. One of the licensee



Control mechanism of Beardmore-Tosi engine

holders has only built a 100 B.H.P. engine for development purposes and then almost closed down their ship-yard through lack of orders, having in our opinion gone into the Diesel game too late, and this latter remark we believe somewhat applies to the third licensee on the Pacific coast, and there is no record of their having ever started work on an engine. During the War the Tosi Company secured considerable publicity in the United States, but a couple of years ago closed their New York office, and apparently lost interest in American development of their engine. Probably post-war conditions in Italy have required nearly all their attention. The third American licensee has built many stationary Tosi Diesels, but no marine engines.

In Great Britain more tangible strides have been made with the Tosi engine, especially with their new four-cycle type. Two firms have acquired licenses, namely, William Beardmore and Sons of Dalmuir, Scotland, and Richardsons, Westgarth & Co. of Middlesbrough, England, the latter having previously built two-cycle marine Diesel-engines under a Belgian license. But their first attempt did not meet with much success, as the engine of the "Eavestone" was replaced by steam machinery. We consider that this was partly due to the licensor at that time not having had sufficient marine Diesel-engine experience to warrant them granting a constructional license. We believe that experience with this particular motorship delayed Furness, Withy & Co. from adopting the Diesel drive on an extensive scale. However, they recently purchased the 11,000 ton single-screw two-cycle Doxford-built motorship "Yngaren," and have since ordered Tosi Diesel-engines to be installed in two steamers building at the Richardson, Westgarth shipyard, instead of the original steam-engines and boilers planned for these hulls, this contrasting with their action on the "Eavestone."

But, Dalmuir and Middlesbrough are several hundred miles apart, so we will return to describing the Tosi engines built at Dalmuir for Messrs. McAndrews' two single-screw fruit-carriers, which were first described in MOTORSHIP over a year ago, when the order was placed. These engines have been constructed under the supervision of James Richardson, who is a frequent editorial contributor to MOTORSHIP.

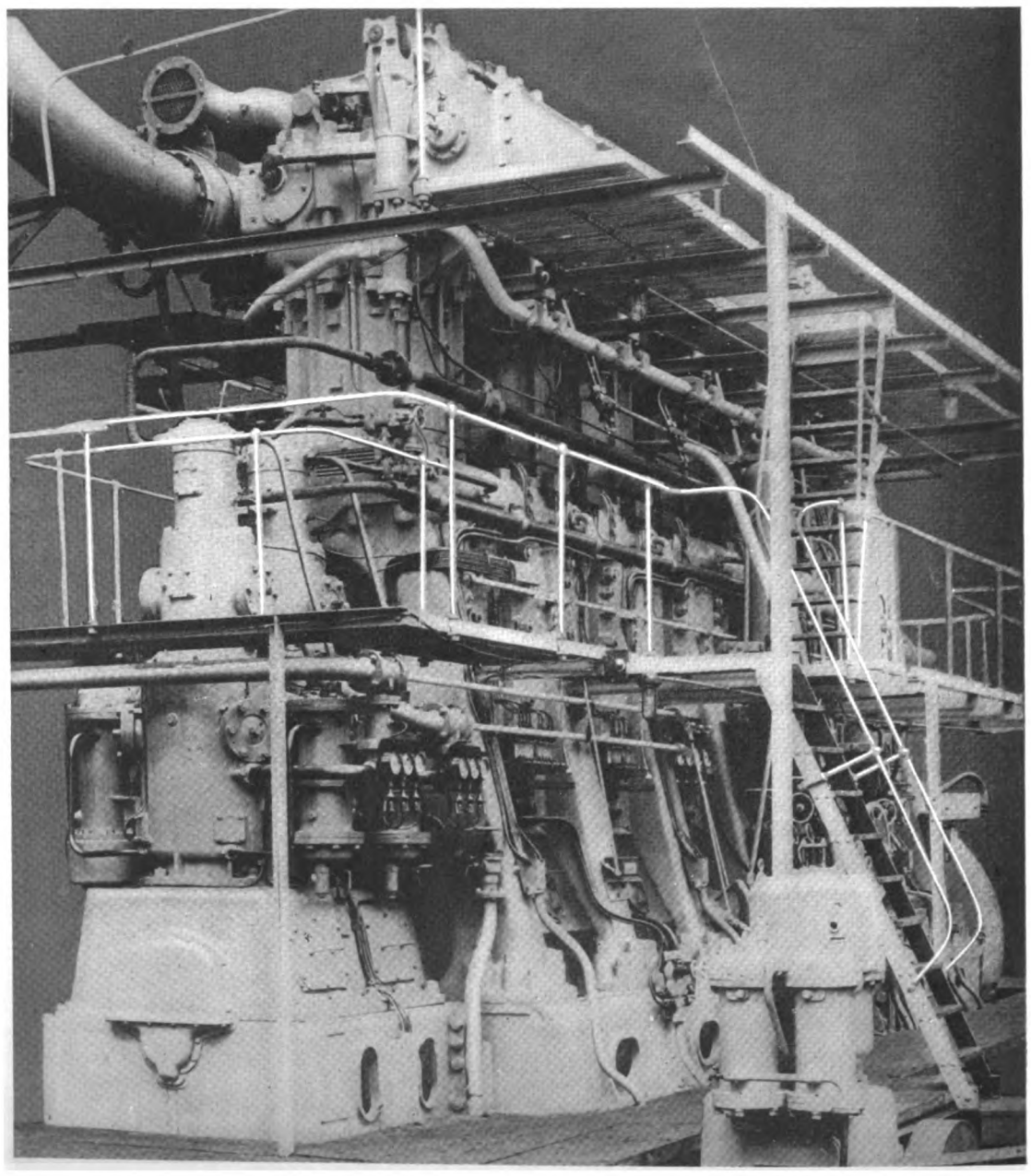
After an exhaustive series of tests the first of the Beardmore-Tosi Diesel-engines is being installed in the "Pinzon," which is of 2,000 tons dead-weight. Of 1,250 shaft horse-power from six-cylinders, this engine is of the single-acting, four-cycle crosshead type and runs at 125 R.P.M. Each working-cylinder has a bore of 620 MM. (28.346") by 975 MM. (38.385") the piston-speed being 890 ft. per minute. The mean effective-pressure on a brake horse-power basis is 75 pounds per square inch, when the above power is being developed, and 97 pounds per square inch on the indicator cards.

Regarding the design, the engine is constructed with separate columns of cast-iron, on which the cylinders are mounted, and bolted together at their base in addition to the column tops. The bedplate is in three sections of box pattern with rounded sump. Main-bearing housings are of circular section, to permit of easy removal of the bottom half bushes.

Bottom diaphragm-plates, with stuffing-boxes for piston-rod and piston-cooling tubes, are fitted to each cylinder, thus separating the crank-pit from the working cylinders and preventing contamination of the main forced-lubrication system. Inspection doors are placed at the back of each cylinder at their base, so that the liners, pistons, piston-cooling tubes, etc., can be readily examined when running.

A special Tosi feature is that the outside of the cylinder liner has spiral ribs cast on the circumference at the top, to ensure high velocity of the cooling-water at this part and even cooling of the liner where subjected to the greatest temperature. These ribs also add to the strength at this part. Readers of MOTORSHIP, early in 1918, will remember this feature in the Tosi submarine engine.

It will be noted that the centre-line of the cylinder and that of the crankshaft are not coincident, but are offset about 60 MM. (2 11/32 in.). This *De-Saxe* setting is claimed to give the following advantages:



Beardmore-Tosi engine of the motorship "Pinzon"

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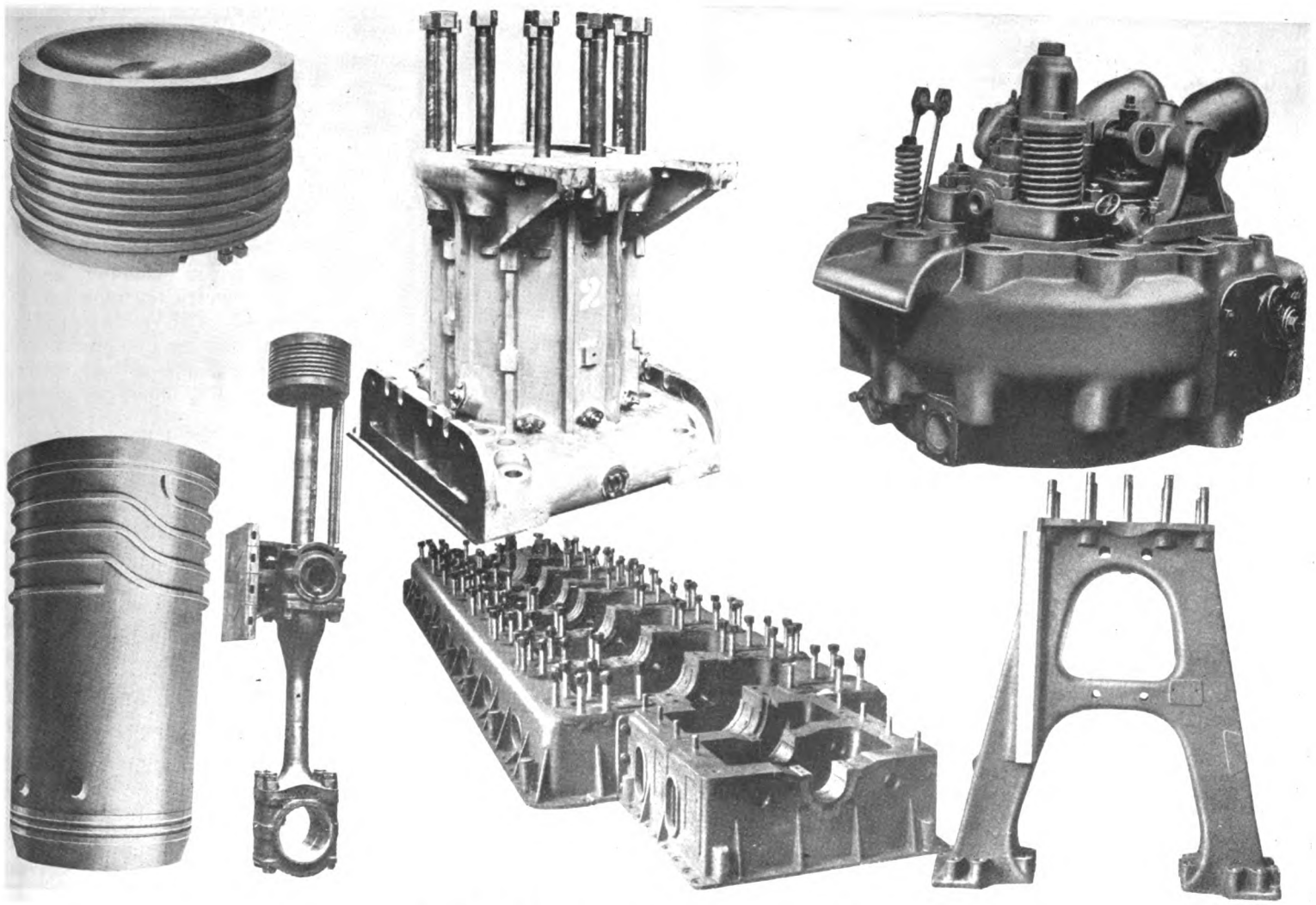


PARTS OF THE BEARDMORE-TOSI ENGINE
Piston; cylinder; cylinder-head; cylinder-liner; piston, crosshead and connecting-rod; bed-plate and frame

1.—The length of the connecting-rod is lessened in the ratio of approximately 3.8 to 4, and the overall height of the engine is reduced accordingly.

2.—Bearing pressures on the ahead and astern guides are more nearly equalized, giving low guide-pressures with the engine running ahead.

3.—A better impulse is given to the piston at the commencement of combustion.

The crankshaft is of the solid-forged type, in three sections, of heat-treated Beardmore steel, the sections being bolted together with flanged couplings. The shaft is drilled axially through the journals and crankpins, and radially through the webs, for forced-lubrication to all the bearings. Speed of revolutions can be reduced to 28 per minute with all cylinders firing, giving a range of speed of from 130 to 28, or 4.65 to 1.

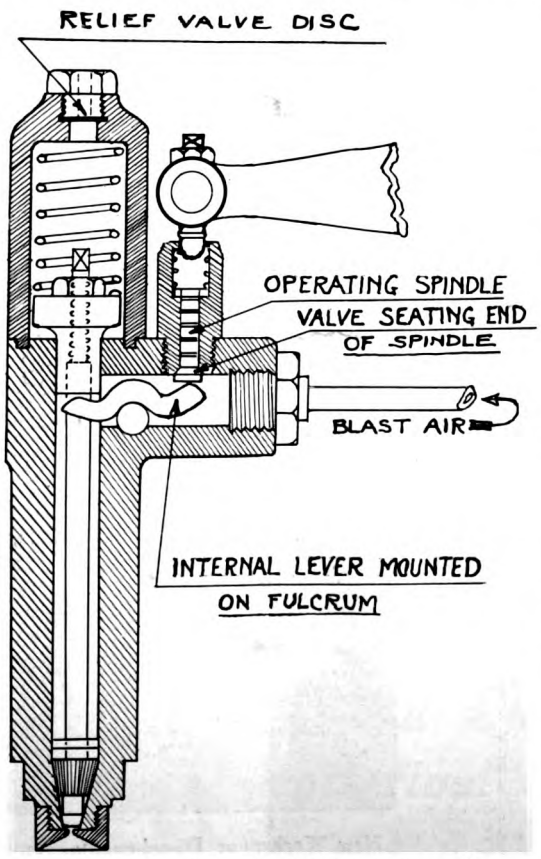
Eight cast-iron spring-rings of the "Ramsbottom" type are fitted to the cast-iron pistons. Fresh-water cooling is provided for the pistons, the gear being of the telescopic type consisting of two pipes, one inlet and one discharge, attached to the piston. Cylinder heads are of special design, allowing an even expansion in the lower part of the head. The material is special-quality cast iron, treated to relieve the casting strains.

In the cylinder-head are the following valves:

(*a*) Air-starting valve.
(*b*) Relief valve.
(*c*) Fuel-injection valve.
(*d*) Two combination inlet-and-exhaust valves.
(*e*) Two "director" valves.

The two combination inlet-and-exhaust valves operate together and function alternately as suction and exhaust. Two valves per cylinder have been adopted to give symmetry of design to the head. They operate in conjunction with an oscillating semi-rotary valve or "director" valve, which places the communication passage with the interior of the cylinder into connection with either the induction or exhaust manifold.

This "director" valve is a cast-steel tee-section shutter, and is made together with its shaft in one piece. It works in a port in the cylinder-head, and controls the flow of gas to and from the combined inlet and exhaust



Section of Beardmore-Tosi fuel-injection valve

valves. It is driven by an eccentric, and is so timed that, as the piston rises on its exhaust stroke with the combined inlet-and-exhaust valve open, communication is made with the exhaust manifold, while the induction manifolds is shut off. As the piston passes the top centre to descend on its induction stroke, the combined inlet and exhaust valve remains full open, while communication is made with the induction manifold by means of the "director" valve, which at the same time shuts off communication with the exhaust manifold.

It will be seen that the combined inlet and exhaust valves in the cylinder-head are exposed to the heat of the exhaust-gases, but immediately afterwards are cooled by the incoming charge of cold air. The "director" valves do not rub on any surface, so cannot seize. Furthermore, they do not require to be reversed for running astern.

The advantages claimed for the arrangement, since two valves serve for either function of inlet and exhaust, and may each therefore be only of half the normal area and size, are:

1.—The uncooled and unsupported portion of the cylinder-head is only 15 per cent. of the total area.

2.—The cylinder-head is therefore at a lower temperature, and is considerably less stressed.

3.—The valves, being smaller, run on this account at a lower temperature. The diameter of valve for a 24⅜-in. diameter cylinder is only 6⅞ in.

4.—The director-valve system ensures that in each cycle the valves are swept by the cool incoming air, so nullifying in some measure the heating effect of the exhaust-gases.

At each end of the air-induction manifold is a grid, and at about the centre is a pipe leading to the common chamber at the base of the cylinders. This chamber is connected

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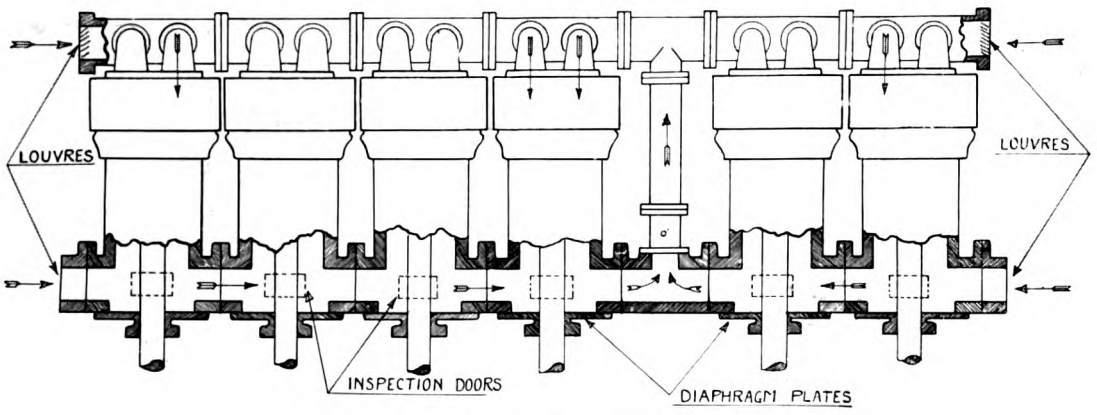


Air-induction system of Beardmore-Tosi marine engine

with the spaces at the under sides of all the pistons, and is totally enclosed with the exception of the louvres fitted in the base of the foremost and aftermost cylinders, and the pipe connecting with the induction manifold. The latter, therefore, scavenges the space under the pistons of the engine; and should there be any blow past the piston-rings due to wear at any time, this escape does not vitiate the atmosphere in the engine-room, but is drawn up into the induction-manifold.

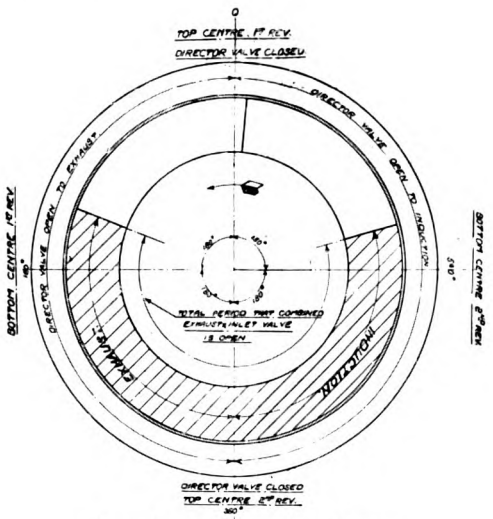
The fuel-injection valve is of the inward-opening needle type, the needle being operated through an internal lever pivoted on a fulcrum. This internal lever serves to reverse the direction of motion given by the operating spindle and to give an inward-opening valve.

The main body of the valve is of high-grade cast-iron. The upper part containing the spring is of cast-steel, and has on top a disc of brass arranged as a relief valve. Should the pressure of the blast-air inside the valve rise above the test pressure of the castings, this disc will burst.

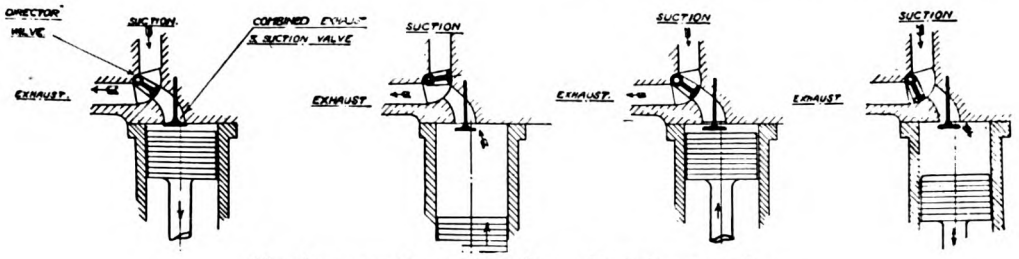
The fuel-duct down the body of the casting leads the oil into the valve above the pulverizing plates and cone, but, in addition, a small channel 2 mm. in diameter passes into the small space surrounding the spindle below the cone. This small charge of oil has been found advantageous when fuel of high specific-gravity or tar-oil is used.

Maneuvering and Reversing

The fuel-valve, starting-air valve and the combination inlet-and-exhaust valves are operated by means of rocker-levers mounted on a fulcrum shaft, and by cams arranged on the camshaft, which is mounted at the top of the cylinders. For reversing the engine there are the ordinary double cams, one for ahead and one for astern running; but instead of moving the camshaft bodily, the cam rollers only are moved to register with their required cams. A light shaft directs the movement of the rollers, and this is operated by a movement worked by a hand lever from the maneuvering platform. When reversing, the fulcrum shaft is rotated until all the rollers are clear of the cams. When in that position a gate in the reversing locking-disc is open for the passage of a steel finger connected with the light shaft directing the movement of the rollers.



Beardmore-Tosi valve diagram



Showing operation of Beardmore-Tosi director-valve

Auxiliary Machinery

All engine-room and deck auxiliary machinery throughout the vessel is electrically driven. No steam-boiler is fitted.

Two Diesel-driven generators are installed for supplying electric current, each capable of an output of 50 K.W. at 220 volts. The Diesel-engines driving the generators are of the same make as the main propelling unit, and operate at the moderate speed of 250 R.P.M.

Trial Data

During a six hours' overload trial of the first engine, the following results were obtained:

I. H. P.	1,766
B. H. P.	1,332
Revs. per minute	129.6
Mechanical efficiency	75.5 per cent.
Mean pressure/B. H. P.	76 lb. per sq. in.
Fuel consumption, B. H. P./hour	0.411 lb.
Blast-air pressure	1,030 lb. per sq. in.

A 100 hours' trial gave the following results:

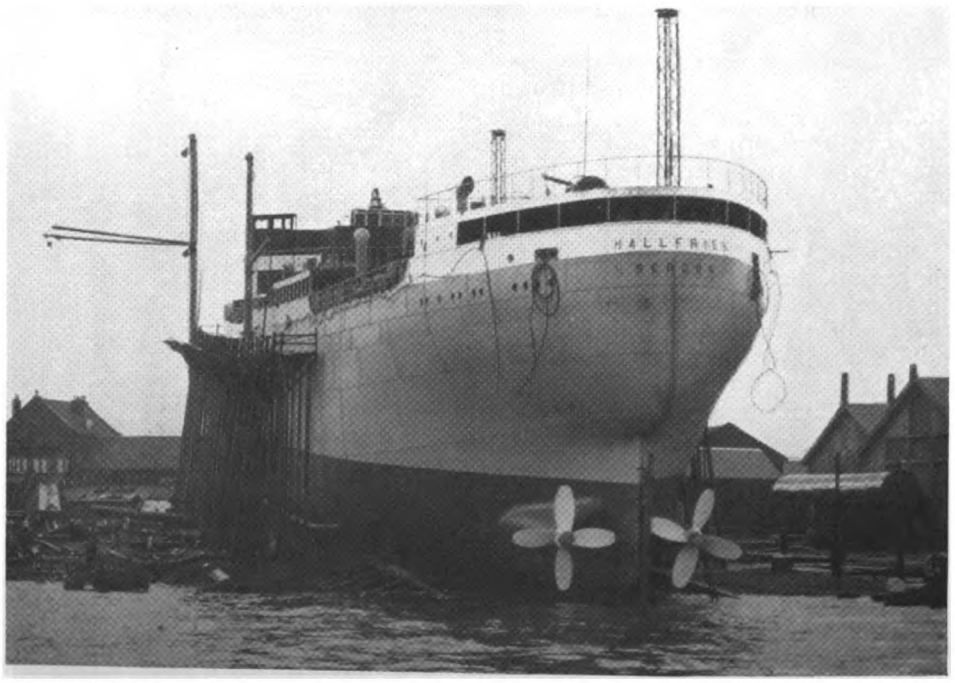
Average I. H. P.	1,646
Average B. H. P.	1,267
Revs. per minute	124
Mechanical efficiency	77 per cent.
Mean pressure/B. H. P.	75.5 lb. per sq. in.
Fuel consumption, B. H. P./hour	0.42 lb.
Lubricating-oil consumption, total for cylinders and loss	4 to 5 gals. per 24 hrs.
Exhaust temperature, average at exit from exhaust valve	550° F.
Lubricating-oil pressure	10 to 12 lb. per sq. in.
Circulating-water pressure (jacket)	10 to 15 lb. per sq. in.
Piston-cooling water pressure	20 to 30 lb. per sq. in.
Water temperature at outlet from cylinder heads	125° F. average.
Piston-cooling water outlet temperature	130° F. average.
Blast-air pressure	1,000 lb. per sq. in.

The engine ran steadily throughout the trial, and at the finish was reversed and run astern for 10 minutes, the time from full-ahead to full-astern being eight seconds.

DOXFORD MOTORSHIP'S MAIDEN VOYAGE

The Transatlantic Steamship Company's new Doxford-built motorship "Yngaren" has made a highly successful maiden voyage. During the 11 days' run from Brixham, England, to Port Said, Egypt, only three stoppages were reported to her single-screw Diesel-engine, which amounted in all to 40 minutes. The first stop arose from excessive lubricating-oil which had accumulated in the scavenging-air box taking fire, which was of very short duration. This being quite a novel occurrence it was deemed advisable to make an examination that occupied 20 minutes. The second stop was due to a break-down of the steering motor, necessitating a stop while the steering-gear was put into hand. The third stop was for five minutes only to clear an obstruction in No. 4 cylinder upper piston-water-service. From Port Said she made a splendid trip to Sourabaya, and then proceeded to Brisbane, Australia. On the latter stage of the voyage she made a non-stop run of 12 days at an average speed of 11 knots.

The sister motorship "Ecknaren," also built by Doxford, has been acquired by Furness Withy & Co. of London and New York.



New Werkspoor Diesel-engined motorship "Hallfried" just prior to her launch at the Rijkee Yard, Rotterdam

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Progress of the Oil-Engine in the Motor Workboat Field

NAVY DEPARTMENT REQUIRES LIGHT-WEIGHT DIESEL-ENGINES

Recently the U. S. Navy Department called for bids for Diesel motors in 2, 4 and 6 cylinders with a cylinder capacity of about 15 b.h.p. The weight of the engine including all accessories must not exceed 60 lbs. and preferably as low as 30 lbs. per horsepower. Bids will be received up to 4th of April, 1922.

DIESEL-ENGINED FISHING BOAT

The fishing-boat "Chas. H. Foster" of Astoria, Oregon, recently arrived at the Atlas-Imperial Engine Co.'s plant at Oakland, California, where her distillate-engine was removed and a 55 h.p. Atlas Diesel-engine was installed.

Atlas-Imperial Diesel-engined Schooner "Atlas"

U. S. NAVY ORDERS KITCHEN RUDDER

One of the U. S. Navy's 35 ft. 100-150 b.h.p. captain's launches is to be fitted with Kitchen reversing-rudders, and the McNab Company of Bridgeport, Conn., the American manufacturing licensees, have been awarded the contract for the rudders.

ANOTHER STEAM-TUG BEING CONVERTED

Osborn & Bornholdt's steam-tug "Rover" is now having her steam-plant removed at the shipyard of William Cryer, at Oakland, Calif., and a 100 h.p. Enterprise Diesel-engine is being installed in its place. She is 63 ft. long, 15 ft. breadth and a 54 inch four-blade propeller turning at 320 R.P.M. will drive her at 10 knots.

ANOTHER SMALL MOTORSHIP MAKES LONG TRIP

A twin-screw motorship of only 162 tons, the "Jhr. V. D. Does De Bye," has arrived at Singapore from the builder's works, J. and K. Smit's shipyard, Kinderdijk, Holland. Two 90 h.p. oil-engines manufactured by the Steijwal Motoren Works of Rotterdam drove this little vessel on this long trip without any trouble, one engineer and an assistant forming the engine-room crew.

ENTERPRISE DIESEL-ENGINES IN WASHINGTON, D. C.

The Sexton Motor Company, of 30 Church Street, New York, recently announced the opening of their Washington Branch, which is located in Suite 322-323 Star Building, Washington, D. C.

Horace Ward, who was Branch Manager of the Van Blerck Motor Company's Washington Office, will be in charge of the new branch of The Sexton Motor Company, who handle the Enterprise marine and stationary Diesel oil-engine in the East. Incidentally the J. V. B. Engine Company, of Akron, Ohio, announces the appointment of The Sexton Motor Company, of 30 Church Street, New York City, to handle their marine sales for the New York and Philadelphia territories.

NEW MOTOR-TUG IN THE EAST

Parts are now being prepared in England to be shipped to the East for the construction of a 65 ft. by 17 ft. by 7 ft. oil-engined tug-boat. This boat will be erected by native labor and a 150 H.P. Robey surface-ignition oil-engine will be installed. This engine will be direct-reversible and 7½ tons of crude-oil will be carried. Designs were by R. C. W. Courtney.

WELDING COMPANY CHANGES LOCATION

We all recall the immense work of repairing the damaged machinery of the interned German ships in the days when this country was just about entering the war. We may also recall that this work was done by the Wilson process, developed by the Wilson Welder & Metals Co., which firm has recently moved its office and warehouse from Bush Terminal to 132 King St., New York City.

DANISH LIGHT-VESSELS USE OIL-ENGINES

Recently the Danish Light House Authorities installed on Light-Vessel No. 17 a three-cylinder 140 h.p. Volund crude oil-engine to provide power for the lights and siren. A similar installation on Light-Vessel No. 4 was made last Spring. It is also intended to equip light-vessels located in the more exposed positions with oil-engines for propelling power, so that the vessels can take care af themselves in case of going adrift in bad weather.

MUNSON STEAMSHIP LINE'S MOTOR-TUG

After investigation, the Munson Steamship Line long ago realized the advantages of the oil-engined tug. Last year when it became evident that a new tow-boat was needed in their work in Cuba, they had such a craft, the "Munevitas" built by the Nyack Shipbuilding Corp. of Nyack, N. Y., in which they installed a 200-h.p. Fairbanks, Morse surface-ignition oil-engine. This tug is of the following dimensions:

Length over all.....85 ft. 5 in.
Breadth.....18 ft. 5 in.
Draft.....8 ft.

We are advised by the steamship company that in the short time the "Munevitas" has been in operation, she has been very satisfactory and replacement of parts have been very infrequent. The fuel-consumption is approximately 15 to 16 gallons of fuel-oil. Both in the forward hold and on deck is space for several tons of cargo if same is required to be carried. The illustration shows a very fine looking and sturdy tug of a type of which we should see more in our harbors.

NEW MOTOR DREDGER

Use of the Diesel-engine in still another type of craft is indicated in the completion of the "Magheramorne," a motor-dredger just completed by Messrs. George Brown & Co., Greenock, Scotland, for The British Portland Cement Manufacturers, Ltd. She has two 80 h.p. Bolinders surface-ignition engines installed and is 96 ft. length over all, 22 ft. 9 in. breadth and 7 ft. 6 in. molded depth. The advantages of the oil-engine in this type of vessel are due greatly to the fact that the propelling engines are in use but very little of the time that the dredger is in operation; no stand-by expense is therefore borne.

WAR DEPARTMENT BUILDS ANOTHER MOTOR-VESSEL

Now building for the Mississippi River Commission of the United States War Department is a small Diesel-engined vessel of 71 ft. length overall, by 66 ft. length L.W., with 16 ft. moulded breadth and 3 ft. 6 in. draft. Her propelling-machinery consists of two 60 to 75 B.H.P. Diesel-engines driving twin-screws at 360 R.P.M. The vessel is being built under supervision of Major Albert K. B. Lyman of the U. S. Corps of Engineers, 1311 International Life Bldg., St. Louis, Mo.

WHALING SCHOONER TO HAVE OIL-ENGINE

One of the sturdy craft which cruises into the Arctic Ocean in search of rich furs and whalebone is the schooner "Herman," owned by H. Liebes & Co. of San Francisco, which craft has been operating with a 250 h.p. Atlas distillate engine. Although the engine has performed with every reliability—which in view of the extremely dangerous character of the work is necessary—the installation of a new Atlas Diesel-engine in its place will save considerable space for cargo which is now used for reserve drums of fuel, longer cruising radius will be permitted, and a saving in cost of fuel in one season of $12,500 will be effected. Therefore, the distillate-engine has been removed and an Atlas-Imperial 250 h.p. Diesel-engine is being installed. As this vessel goes into the northern seas where there is no chance of making port to repair, any work necessary on her machinery must be done hundreds of miles from civilization; she therefore carries spare parts so that the engine cannot be put out of action permanently.

Munson Steamship Line Motor-Tug "Munevitas"

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Excellent Example of Modern Motor-Tug

The Tow-Boat "John T. Hughes," Propelled by a 100 H.P. Fairbanks-Morse Oil-Engine

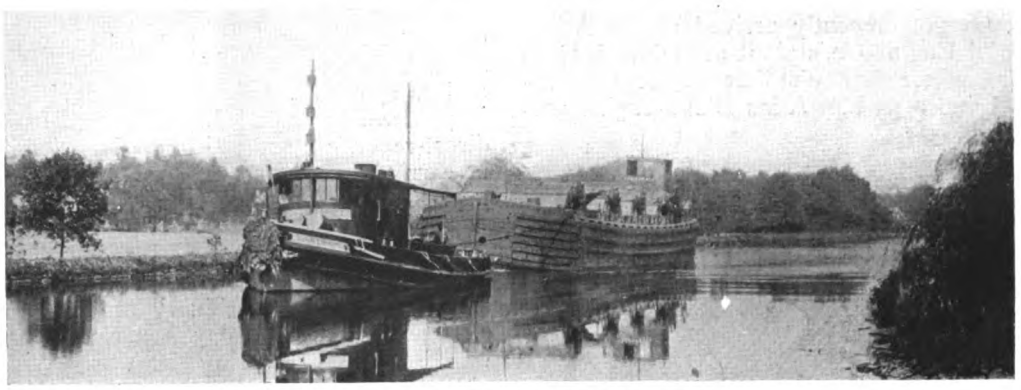
When a veteran owner and operator of steam-driven craft builds a tug-boat propelled by an oil-engine, operates that tug successfully in competition with steam-propelled tugs, and gives as his verdict that the oil-engined tug is better and more economical in every way, other owners should not ignore such an opinion. John T. Hughes of New York City, N. Y., has done this and his story therefore carries weight. "Motorship" has long advocated the oil-engine for tug-boats, because it has known that equal work could be done with very low fuel-expense.

Mr. Hughes put in operation in May, 1921, a motor-tug, named "John T. Hughes, after him, and has given this craft a thorough test in heavy work. Part of her work has been towing three or four loaded barges carrying approximately 350 tons each between New York and Norfolk, Va. On this trip she has to pass through the canals, the several bridges over which limit the height from water-line to top of stack to 14 ft. 6 ins. The draft is limited for some of the work which she must do, and tanks are therefore provided which, when empty, reduce the draft to 6 feet and when filled the tug draws sufficient water to be steady and seaworthy for the most severe weather encountered on Chesapeake Bay. Our illustration shows her towing on the canal. The principal dimensions are:

Length over all.....70 ft. 0 in.
Breadth.....19 ft. 6 in.
Draft.....6 ft. 0 in.
Fuel-oil capacity.....150 hours running
Lubricating-oil capacity...300 hours running
Fresh water capacity.....3,000 gals.
Speed, light.....12 knots

The propelling plant consists of a 100 h. p. Fairbanks-Morse surface-ignition oil engine, in addition to which are auxiliary fire and wrecking-pumps, driven by a belt from the main engine. The boat can tow a barge and have all auxiliaries operating at the same time.

One instance taken from the record of the "John T. Hughes" indicates the advantages possessed by the oil-engined tug. This vessel and a steam-tug were laying at the same dock when orders were received by both tugs to proceed to a certain point to handle a towing job. She was on her way inside of three minutes after getting word; but the steam-tug had to get up steam and could not proceed until 4 hours had elapsed. As the run of 35 miles took the "John T. Hughes" about three hours she was on the job one hour and a half before the steam-tug left the dock, the latter tug losing the contract at a time when towing contracts were scarce. Tugs of the oil-engined type should be more numerous, and they undoubtedly will be as their advantages are more fully realized.

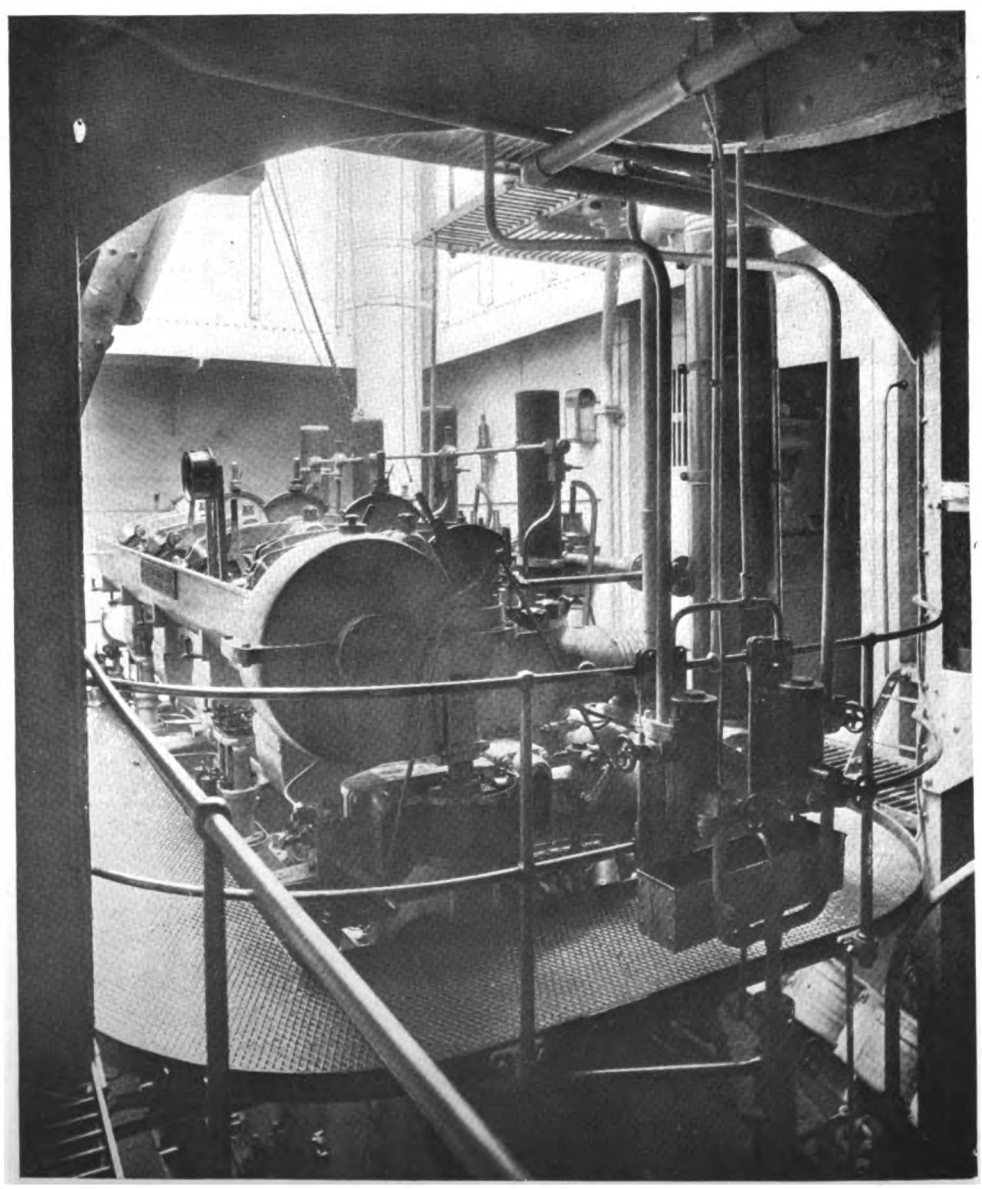


The oil-engined tug "John T. Hughes"

KING VISITS TRAINING AUXILIARY

Accompanied by H. N. Andersen, head of the East Asiatic Company, the King of Denmark recently inspected this Danish motorship-company's new Diesel-driven auxiliary trainingship "Kobenhavn," which is now en route for Australia, via San Francisco. As the public was admitted, a huge crowd filled the ship while the King addressed the eighteen cadets, who four years hence will be officers and engineers of big motorships of the company's fleet. As previously stated, she is a fine steel five-master with a handsome figurehead on the stem, and is of 5,000 tons deadweight, is the second hull built for the purpose by Ramage and Ferguson, of Leith, Scotland, the first having been used as a coal-hulk during the war by the British Admiralty. An illustration of the "Kobenhavn" and of her Diesel engine, were given in our December, 1921, issue. This engine is a Burmeister and Wain six-cylinder, stationary model of 600 i.h.p., driving a Zeise reversing-and-feathering propeller. In the engine room there are two 15 b.h.p. Bolinder surface-ignition oil-engines driving electric-generators, for the lighting, heating, and pumping service, also for the wireless. Kerosene lamps are also fitted throughout the ship. Hoisting and lowering the sails is carried out by hand, this forming part of the training of the cadets. For serving the four cargo-holds there are four winches, each driven by a 25 b.h.p. Oberursel gasolene-kerosene engine of the electric-ignition type. The engine at the forward hatch also operates the anchor windlass. The sails have a total area of 56,000 sq. ft. Her length is 309 ft. by 49 ft. breadth and 28 ft. 7 in. depth and 215 tons of fuel-oil is carried in the double bottom.

The vessel is under command of Baron Juel-Brockdorf, an ex-submarine officer. He, the first-mate, chief engineer, doctor, and the two passengers have well-equipped staterooms, and a dining saloon. There are five mates and three engineers.



Engine-room of the big auxiliary "Kobenhavn"

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Interesting Notes and News From Everywhere

PENNSYLVANIA RAILROAD TO BE MOTORSHIP OWNERS

Some new Diesel-electric ferry-vessels and Diesel-tugs are being planned for early construction by the Pennsylvania Railroad.

MEXICAN GOVERNMENT TO ORDER MOTOR VESSELS

Four Diesel-driven sea-going firefloats and two Diesel-driven river fire-boats are to be ordered shortly by the Mexican Government.

SELL STEAMERS AND BUILD MOTORSHIPS

The Grangesberg-Oxelosund has received permission from the Swedish government to sell four steamers aggregating 22,098 tons. They are building 16 new Diesel-engined ships.

NEW CONCRETE MOTORSHIP UNSEAWORTHY

Two days after the reinforced concrete motorship "Gotaelf" ran her trials she was found to be unseaworthy. She was built by Friedrich Sternemann, at Wewels-fleth, Germany. The Sulzer Diesel-engines of the "Gotaelf," will be installed in a new iron hull by the same owners.

ANOTHER CAMMELLAIRD-FULLAGAR DIESEL LICENSE

A license to construct marine Diesel-engines to the Cammellaird-Fullagar design has been secured by Smith Dock Co., Ltd., of Middlesbrough, South Shields, and North Shields, England.

CONVERSION OF FISH-CARRIER "THREE SISTERS"

At the yard of William Cryer at Oakland, Calif., the 60 ft. fish-carrier "Three Sisters," which was formerly operated by a 110 h.p. distillate-engine, has had this engine removed and a 100 h.p. Enterprise Diesel-engine installed.

TEN DIESELS ORDERED FOR CANAL MOTORSHIPS

As we go to press we have been advised that the contract for ten 150 b.h.p. Diesel-engines, which will drive the electric-generators for the Livingston design of New York State Canal packets, has been awarded by Major Philip Hammond, President of the Canal & River Transportation Co., New York, to the McIntosh & Seymour Corporation of Auburn, N. Y. As yet contracts for the hulls, electrical equipment, and auxiliary machinery have not been awarded.

SUBMERGED OIL-ENGINE OPERATES IMMEDIATELY AFTER RAISING

The "Tacoma," owned by the International Produce Co., was recently under water for six days. Her pair of 45 h.p. Fairbanks, Morse surface-ignition oil-engines were started a half-hour after the boat was raised, and within one hour the "Tacoma" proceeded on her way under her own power.

TWO MORE MOTORSHIPS ORDERED IN GREAT BRITAIN

Furness-Withy & Co. of London and New York have ordered Diesel-engines to be installed in two new ships originally planned as steamers. These vessels will be installed with Tosi Diesel engines built by Richardsons-Westgarth of Hartlepool, England, under license, the first announcement regarding which license was published on page 901 of the November issue of MOTORSHIP.

INDICATIONS OF MOTORSHIP BUILDING ACTIVITY

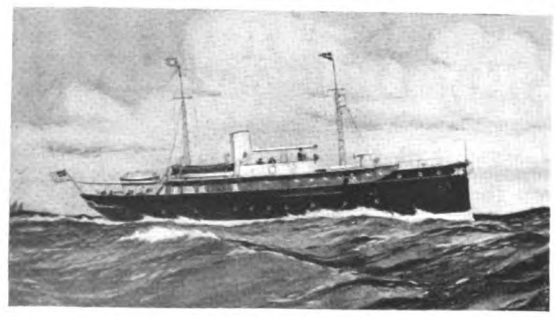
One of "Motorship's" advertisers manufacturing deck auxiliary equipment reports that during a recent month *bona fide* inquiries for equipment totaling $1,117,000 were received and that three of the very largest shipyards in the United States have adopted his equipment as standard in the new motorships and in the conversions from steamer to motorship upon which they plan to engage.

NEW AMERICAN DIESEL ENGINE

Now being developed by the Allison Engineering Company of Indianapolis, Ind., is a six-cylinder 100 B.H.P. airless-injection Diesel-engine of the light-weight, high-speed type, which will be constructed in sizes up to 500 B.H.P.

NEW MOTORSHIP SERVICE BETWEEN SWEDEN AND DENMARK

A new service between Gothenburg, Sweden, and Aarhus, Denmark, has been inaugurated by the motorship "Evelyn." This, we believe, is the American-built 1584-ton auxiliary schooner built by McEachern & Co., at Astoria, Ore., in 1918 for A. O. Anderson & Co. She has two 240 H.P. Skandia surface-ignition oil-engines.



A 100 ft. motor-yacht building for Alfred I. du Pont at the Jackson-Sharpe plant of The American Car & Foundry Co., Wilmington, Del., from designs by Edward R. Carroll

PERFORMANCE OF STANDARD OIL TANKER "CHARLIE WATSON"

During her first year's operation, the Standard Oil Company's 2,500 tons deadweight Pacific-Werkspoor Diesel-engined tanker "Charlie Watson" covered 48,258 nautical-miles in 38 voyages. Her larger sister tanker, "H. T. Harper," also Pacific-Werkspoor Diesel-engined, uses 14 degs. Baumé fuel-oil.

AIRLESS INJECTION OF FUEL IN 1892 A.D.

It is not very widely known that the first experimental Diesel-engine built about 1892, had airless injection of fuel. It only ran a few revolutions. The second engine which started its four years' tests in 1896 had compressed-air injection of fuel. Upon this second engine the true Diesel cycle is based.

The Avance-engined Indian trading vessel "Kundgram"

AN AUXILIARY BARQUE BUILT IN INDIA

Interest in India is increasing in auxiliary trading vessels, and on this page is an illustration of one of the largest vessels propelled by oil-engines which has yet been built in that country, the "Kundgram." There is installed a 360-400 B.H.P. Avance direct-reversible surface-ignition oil-engine which enables this vessel to run on schedule. For nearly a year this auxiliary has been in service, as well as two other vessels with Avance oil-engines, the "Ayra" and the "Ayravarta," equipped with 2-cylinder 100 h.p. and 2-cylinder 130 h.p. respectively. All three ships are owned by Maganlal, Pranjivan & Co.

CORRECTION IN PRICE OF BOOK "MEX. FUEL-OIL"

In our November issue we reviewed the very interesting little book "Mex. Fuel Oil" issued by the Anglo-Mexican Petroleum Co., and the price was given at £10-6-0 net. This price should read 10s. 6d.

MOTORSHIP TAKES BIG LOAD OF LUMBER

The East Asiatic Company's big motorship "Panama" was due to load 4,500,000 ft. of lumber at Puget Sound and Columbia River ports for the Orient during the middle of January. The motorship "Chile" recently loaded lumber at Everett for the Antipodes. Meanwhile many uneconomical American steamers are idle!

PERFORMANCE OF THE "AFRIKA"

The Danish East Asiatic Company's 14,000 tons d.w. motorship "Afrika" recently arrived at Stockholm after her third voyage around the world, covering a distance of 150,000 nautical-miles. Her navigation was assisted by means of the Navigator log installed. This instrument has also been in successful operation in a Diesel motorship "Malaya."

INTERLOCKING ENGINE-CONTROL WITH BRIDGE TELEGRAPH

In the North Eastern Werkspoor-engined motorship "Sevilla," a special device is fitted in order to avoid error upon the part of the engineer-on-watch. This is an arrangement whereby the engine-room telegraph is interlocked with the reversing-gear in such a manner that the mechanism can only be set at "forward," "astern," or "stop" position depending upon the position of the bridge telegraph.

LARGE SEA-GOING MOTOR-YACHT "SEA KING"

Baron Bliss, of Bahamas, West Indies, has recently taken delivery of a new yacht for use in cruising among the West Indies from the builders, the Nova Scotia Steel & Coal Co., of New Glasgow, N. S. This vessel is 137 ft. long, 28 ft. 6 in. breadth and 13 ft. depth and has installed two 250 h.p. Vickers-Petter surface-ignition oil-engines which will drive her 11 knots. She is luxuriously furnished and has lighting and refrigerating-plants. Many years ago we had the pleasure of going aboard one of Baron Bliss's yachts.

MOTORSHIPS "BOOBYALLA" AND "BABINDA" START NEW PACIFIC COAST SERVICE

A new service on the Pacific Coast has been started by the Ocean Motorship Company of San Francisco, with their wooden motorships "Boobyalla" and "Babinda," both of 4,400 tons d.w.c. and powered with twin 500 b.h.p. McIntosh & Seymour Diesel-engines. Portland, San Francisco, Oakland, San Pedro and San Diego will be ports of call. It is interesting to note that full-powered wooden ships have been successful in operation during a period when hundreds of steel and wooden steam-driven ships are laid-up.

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Single-screw motorship "Balzac," owned by Fred Olsen, engined by Burmeister & Wain and built at the Odense Shipyard. A sister vessel has been launched

FRED OLSEN'S NEW MOTORSHIP "BALZAC"

The First of Two Sister Single-Screw Cargo-Vessels

Now that Fred Olsen, the well-known Norwegian shipowner practically controls the Thoresen fleet, he owns quite a number of Burmeister & Wain Diesel-driven vessels built in Norway and Denmark, as well as several Dutch & British Werkspoor Diesel-engined vessels, and no doubt some of these economical ships will enter into active competition with "antiquated" American steam-driven craft, which burn three times as much fuel and carry ten per cent less cargo.

Among his new motorships is the "Balzac," which is one of two 1,350 tons d.w.c. vessels, the second having been launched early in December. The "Balzac" is further advanced and is in service, having run her trials on Dec. 10th. Preliminary details of these vessels were given in MOTORSHIP for March, 1921, on pages 217-218. The hulls were built at the Odense Shipyard, Odense, Denmark, which is controlled by A. P. Moller, who is also considered as being one of the most enterprising shipowners in that country. The Diesel-engines were built by Burmeister & Wain of Copenhagen. Mr. Moller is also managing-director of the Svendborg Steamship Co., owners of the long-stroke B. & W. engined single-screw motorship "Leise Maersk." The dimensions of the "Balzac" and her sister-ship as finally completed are:

Length O. A.	215'0"
Breadth M D.	34'6"
Depth to M.D.	15'0"
Draught	14'0"
Cargo Cubic—Capacity (grain)	84,200 cu. ft.
" " " (bales)	77,820 cu. ft.
Fuel Capacity	309 tons
Power, Indicated	890 h.p.
" Shaft	660 h.p.
Class	Norwegian Veritas *A1

In addition to the above fuel-capacity of 309 tons, the two starboard and the two port tanks hold a total of 239 tons of water or 230 tons of oil, while the fore and aft peaks together hold 70 tons. They are single-screw vessels and each is equipped with a six-cylinder 890 i.h.p. Burmeister & Wain four-cycle Diesel-engine developing 660 shaft h.p. at 130 r.p.m., the bore and stroke being 500 mm. (19.685 in.) by 900 mm. (35.433 in.). It drives a four bladed manganese bronze propeller.

For auxiliary purposes in the engine-room aft there are two single-cylinder 50 b.h.p. B. & W. Diesel-engines driving Thrige 30 k.w. electric-generators at 400 r.p.m., which provide current for a number of Thrige electric-motors operating the various winches, pumps, etc. For heating the ship there is a Kryger donkey-boiler made in Copenhagen. The two hatches are served by four 3-ton Thrige electric winches.

On December 10, 1921, the M.S. "Balzac" ran her trials in Copenhagen Sound. The speed over the measured-mile worked out at 11.19 knots, the mean draught being 8 ft. 2 in. The engine developed 1,040 i.h.p. at 132.7 r.p.m. and a mean-pressure of 6.67 kg.

During the consumption-tests the indicated horsepower was 1,048 at 133 r.p.m. (the normal revolutions being 130), the mean-pressure 6.69 kg., and the displacement of the ship 1,210 tons. The consumption worked out at 130.3 grams per horsepower hour.

PERFORMANCE OF SINGLE-SCREW 4,500 TONS MOTORSHIP "LEISE MAERSK"

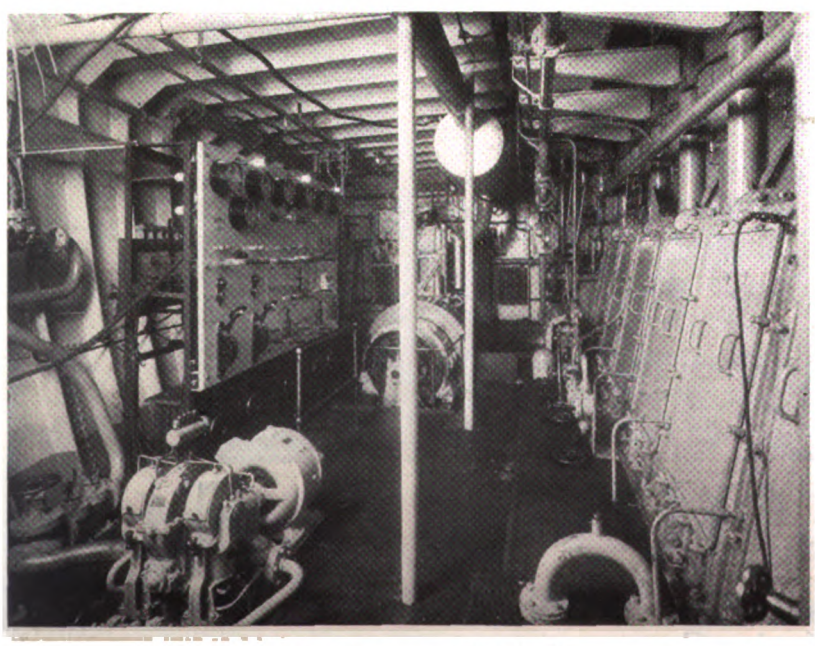
Voyaging Round the World at 10 Knots on Less Than 500 Tons of Fuel-Oil

In the October 1921 issue of this magazine, was fully illustrated and described the single-screw Burmeister & Wain-engined 4,500 tons motorship "Leise Maersk."

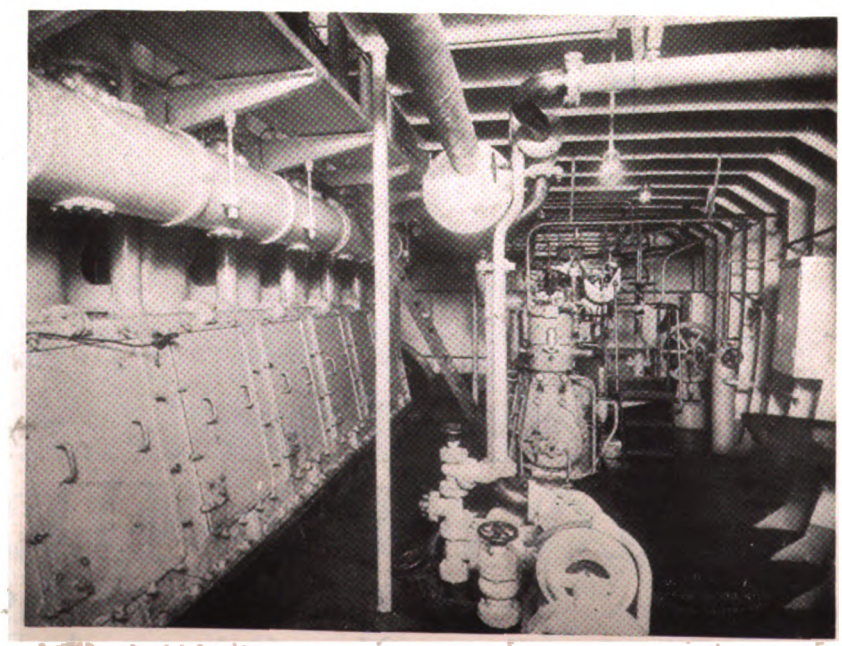
Following her trials she left for the Far East via the Kiel canal, where she took aboard oil-fuel at Brünsbuttel, said to be German oil. Her performance on her outward maiden voyage was as follows:

Voyage	Date	Average Speed	Average Engine-Speed	Daily Fuel-Consumption
Brünsbuttel—Port Said	Sept. 12-26	9.84 knots	81 R.P.M.	4.53 tons
Port Said—Batavia,	Sept. 28-Oct. 18	10.32 knots	83 R.P.M.	4.6 tons

She had aboard a cargo of Portland ce-



Port side of engine-room of "Balzac"



Starboard side of m. s. "Balzac's" engine-room

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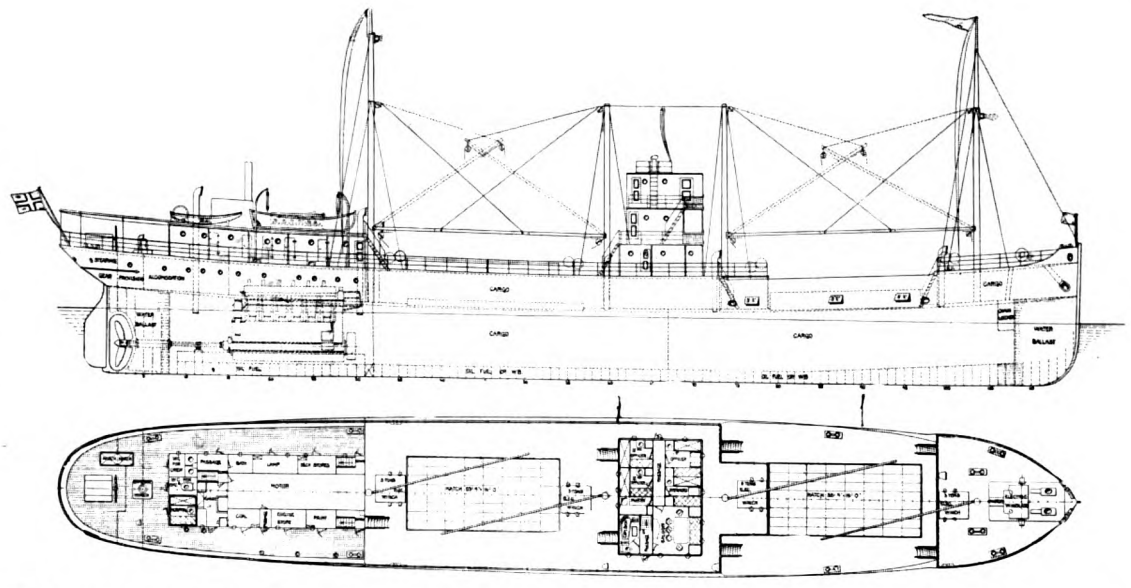
ment, and her draft on the above two legs of the voyage was 17 ft. 6 in. and 17 ft. 3 in. respectively. She discharged this cargo at Batavia and proceeded to Semarang, thence to the Gilbert Islands via Borneo, where additional fuel was due to be taken aboard prior to her return to Europe via the Panama Canal and America. Thus she will practically circumnavigate the world, which she probably will do on less than 500 tons of fuel-oil, judging by the consumption from Germany to the Dutch East Indies of only 4½ tons per 240 nautical-miles.

This fuel-consumption includes that of one auxiliary Diesel-engine in continuous operation. The lubricating-oil consumption was 60 lbs. per 24 hr. day and includes the waste in the tank.

On one fine day the "Leise Maersk's" main engine developed 1,446 i.h.p. at an m.i.p. of 94 lbs. per cylinder at 83.44 revs. per minute, the ship's speed averaging 10.74 knots on 4.6 tons of fuel-oil and 20 lbs. of lubricating-oil for a period of 23 hrs. 50 mins.



Single-screw motorship "Balzac," built by the Odense Staalskibsvaerft, and Diesel-Engined by Burmeister & Wain

REVIEW

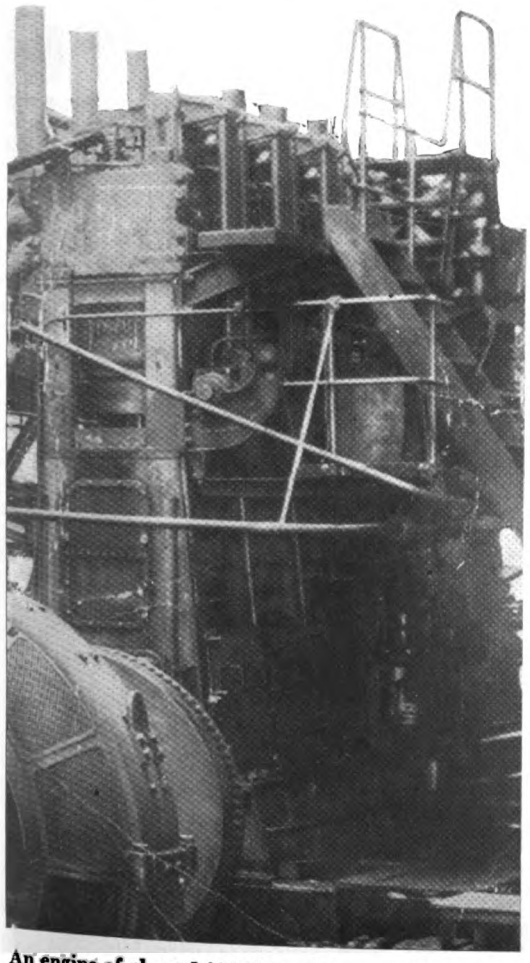
Annual Report of the Director, United States Coast and Geodetic Survey, for the fiscal year 1921. 147 pages together with 35 charts and maps. Washington, D. C., Government printing office. This annual report of the director, E. Lester Jones, of this very important government bureau has just been issued and contains much valuable data regarding the exacting work carried on. Possibly the average tax-payer or member of Congress does not realize that this bureau, which surveys our coasts, prepares charts for the guidance of mariners, and renders navigation safe in waters which are constantly changing as regards currents, bottom, and depths, is just managing to function on the very meagre funds provided, because of the loyalty of its personnel. Mr. Jones makes a candid statement of the hindrances in the way of best work thru lack of proper salaries as compared with other bureaus of the government service, lack of suitable vessels to carry on the work of survey which must be done in the most exposed and dangerous waters along the coast by highly-trained technical men, and thru lack of quarters suited to the work. Hydrographic survey on the coastal waters is not the only work which is being held back because of these hindrances, as the business interests of the country are calling for the completion of the topographic map of the entire country.

But because of the hundreds of wrecks on our coasts which cost many lives and millions of dollars worth of vessels the Survey needs most urgently suitable vessels in which to carry on surveys of currents, changes in depths, etc. The wreck of the passenger steamer "Alaska," last August, on the California coast was undoubtedly due to uncharted currents which swept the vessel onto the reef, costing scores of lives. Of the 11 vessels now operated by the bureau only three can work in exposed waters; and not only must our coast be surveyed, but the shores of the Philippines, Virgin Islands, Porto Rico, Hawaii and Alaska as well. One hundred years of experience has shown that a vessel of 1,000 tons displacement is the largest that can be used in this work. (This is a craft of not over about 150 ft. length, and for such a craft there are a great many Diesel engines of say 300-400 h.p. available that would prove admirable for the work. Editor.) For work in shallow and more protected waters smaller craft are needed.

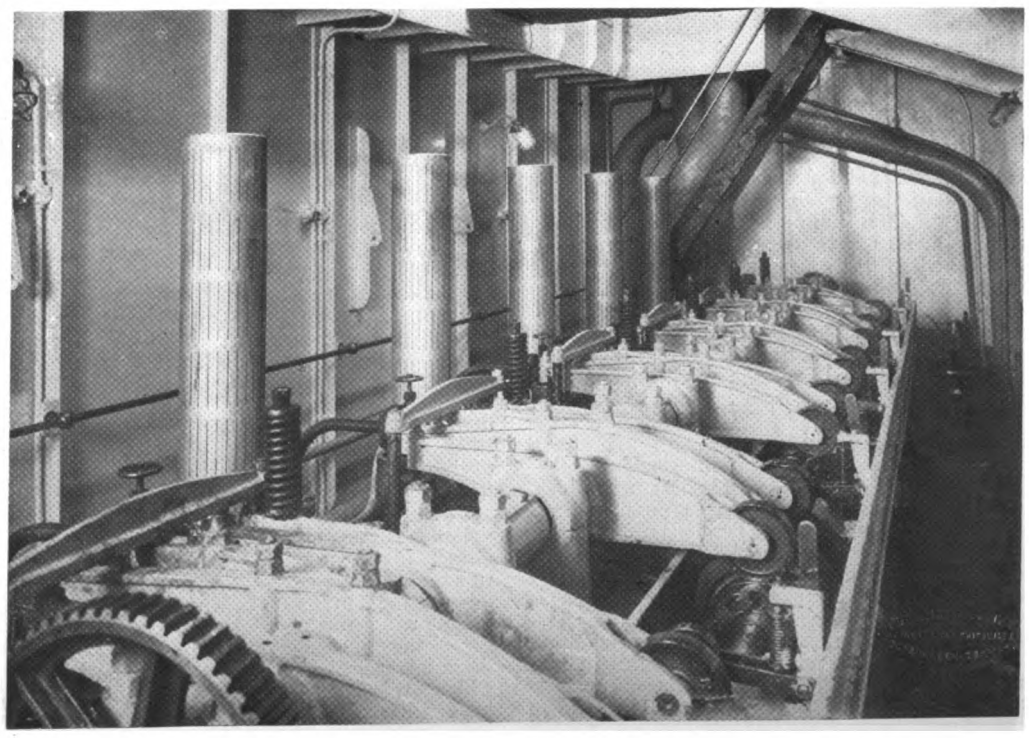
A reading of this report should convince anyone of the valuable contribution of this bureau to the marine interests of the country and of the justice of the bureau's claim for sufficient funds with which to prosecute this needed work.

SWEDEN'S MOTORSHIP FLEET INCREASES

On September 30, 1921, the Swedish merchant marine consisted of 2,798 ships totalling 1,162,000 tons register. Of these 1,228 were steamers, 927 sailing-ships and 643 were motorships, the proportion of motorships to the total number of ships being 23 per cent. Of the 16 vessels totalling 15,700 tons which Sweden added to her fleet during the 4 months from July to October only 6 were steamers of 5,670 tons, while 10 were motorships of 9,000 tons.



An engine of about 1,000 i.h.p. of the new Burmeister & Wain design under construction. The upper part follows the new long-stroke model



Engine-room of single-screw motorship "Balzac," showing valve operating mechanism

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Our Readers' Opinions

(The publication of letters does not necessarily imply Editorial endorsement of opinions expressed)

THE FUEL-OIL SITUATION

To the Editor of MOTORSHIP:

I have read with a great deal of satisfaction your editorial in the December number of MOTORSHIP, relative to research in the burning of heavy-oils in Diesel-engines at some leading American University. This suggestion should be looked on with favor by oil companies, engine manufacturers, engine users and the universities in question. The uninformed are asking what is to become of the Diesel-engine when the oil supply is exhausted. The supply will not be exhausted for some time to come, but neither is it unlimited. The Diesel will be called upon to burn heavier and poorer grade fuels as time goes on, but it will not be discarded because of "lack of fuel."

The present oil-burning engine has been brought to its present state of development almost entirely by individual companies. Their engines have been covered by patents which have been a protection from competition. In providing fuel, however, the case is somewhat different. Several companies will sell heavy and poor grade oils, either at the same port or possibly in different ports of the world, which will require special apparatus for burning. The burning of this oil successfully would be a problem to be solved by both the oil company and the engine user. The writer assisted in running tests on an engine in 1916, using Mexican crude which would not flow from the barrel until heated, and knows some of the difficulties to be overcome.

The field is broad for there is a possibility of using vegetable oils; and coal-tar is being burned in many places. It would appear that herein lies the big field for investigation in view of the large amount of coal in the world. In the meantime it would be a fine thing to curtail the use of oil under boilers. It would certainly be a real step forward in the advance of the Diesel engine to institute investigations along the lines you have suggested.

FORREST E. JONES,
Instructor Mechanical Engineering, University of Texas, Austin, Texas.

REGENERATION OF AMERICA'S MERCHANT MARINE

To the Editor of MOTORSHIP:

I certainly am interested in Diesel power as the better means of ship operation. Your proposal for the conversion of ships seems to me very practical. If the plan were approved by the Board I would not hestitate in supporting that policy.

WILLIAM S. GREENE,
Chairman.
Committee on Merchant Marine & Fisheries,
House of Representatives.
Washington, D. C.

NOMENCLATURE OF OIL-ENGINES

To the Editor of MOTORSHIP:

The underlying reason for the loose and frequently improper application of the term "Diesel" to almost any type of heavy oil-engine was strikingly revealed in a recent meeting of some fifty men, all professionally connected with such matters. In such a gathering it was remarkable that a request for the defining of the limitations of this term elicited less than half-a-dozen attempts at compliance and these but emphasized the general vagueness upon the subject.

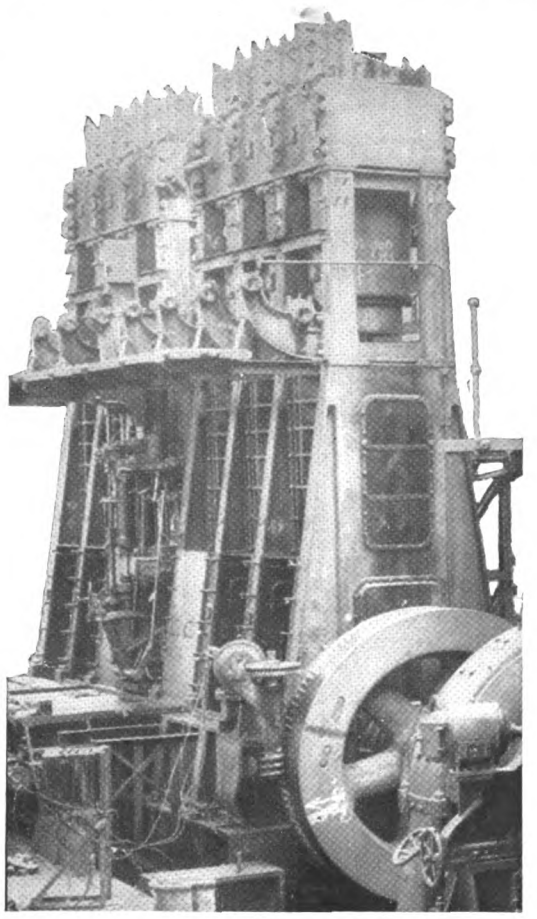
It is to be realized, of course, that no valuable innovation long remains in the form in which it was conceived. Too many minds are at once concentrated upon its development. Furthermore, if it may be likened to one of the species of a common genus, hybrids are not to be unexpected and, when hybrids prove their right to survive, they are entitled to recognition by a distinct designation. This analogy is distinctly applicable to the broad family of internal-combustion engines and the only proper means of reaching a just solution is to trace the genealogy back to its source which is in the twin physical laws formulated by Charles and by Boyle.

From these were learned the interlocking relations of pressure, volume and temperature which led to the conceptions of the three possible heat cycles and of the broad classifications of the engines in which they are exemplified. In the chronology of their exploitation, they are—

The "Constant Temperature" cycle which is known as that of "Carnot," because of the enunciation of its possibilities by him in his formulation of many basic facts underlying our present day Thermo-dynamics. This cycle has been carefully analyzed by latter day authorities who have shown its excellent Thermal possibilities, but it has never been developed commercially because these analyses indicate the necessity of a very heavy engine to meet modern requirements in mean effective effort.

The "Constant Pressure" cycle is known as that of the American "Brayton" by whom it was not only originated, but by whom it was reduced to a commercial fact as far back as 1873. This engine bears to internal-combustion engines very much the relation that Watt's steam engine bore to the preceding ones of Newcomin's and others. Incidentally, it may be remarked, it was one of Brayton's engines which propelled the first power-driven submarine, designed and built by that other American, Holland. In Brayton's engine air was compressed into a receiver from which it was admitted into the cylinder through a passage wherein it gathered variable and controllable quantities of oil.

The "Constant Volume" cycle is called "Otto's," after Dr. Otto by whom such engines were designed and commercially introduced in 1876. He



Long-stroke type of Diesel-engine under construction at Burmeister & Wain yard, Copenhagen

followed the theoretical requirements and the processes of the 4-stroke cycle published by Beau de Rochas in 1862.

These pioneers were followed in the order of time and distinction by a host of others who reduced the embryo art to the beginnings of a science and produced many of the sub-types which may be likened, in the adopted analogy, to the "breeds" of internal-combustion engines.

Chiefly, these latter followed the Otto cycle using gaseous fuels or volatile oils which were not then in great demand. Using these, they universally inhaled the combustible mixture during the suction stroke, compressed it during the return stroke and fired it explosively until, in 1888, Hornsby and Ackroyd originated and introduced the novel practice of inhaling only air which was compressed during the return stroke and at or about top center they sprayed into it, and against a hot surface, a non-volatile fuel. Thus, for seven years before Dr. Diesel introduced his first engine, there was in common use the class now named as "Diesel" with the belittling prefix "semi."

Following the line of development, or, to continue the analogy, tracing the line of descent, there is reached in 1895 the prototype of the engine which owes so much to the multitude of men who have advanced it to its present position. In that year Dr. Diesel brought out an engine which strikingly exemplified the well appreciated fact that increases of compression spell increased efficiency, and, in this engine, the rate of compression was raised to such an extent that not only did auto-ignition replace the means previously employed for igniting, but rendered available grades of fuel of little previous value.

From this point on Dr. Diesel figures less prominently in the history of internal-combustion engines than do many of those whose names can never be generally known, so that, no further facts are necessary to a just determination of the limitations than to weigh those already recited.

At a first glance it will be seen that although his engine is generally classed as one operating on the constant-pressure cycle, he neither originated that feature nor could any known successors of his engine exhibit the characteristics of Brayton's engine for more than a few degrees of shaft rotation, without an entire modification of any generally known means of fuel injection. Could one be made to do so, it would long since have been adapted to locomotive drive. He certainly did not originate the procedure of admitting air alone for compression and later adding the fuel content.

Stripped at least of the features to be credited to Brayton and to Hornsby and Ackroyd by reason of their thoroughly established priority, there begins to be reached the new and original ones introduced and advocated by Dr. Diesel, hence the limitations sought, to wit: An internal-combustion engine operating for a limited period on the contant pressure cycle in which high fuel economy is secured, auto-ignition produced and low grade fuels consumed through relatively high compression and the temperatures corresponding thereto.

For the dates employed reference has been made to "The Gas, Petrol, and Oil Engine" by Sir Dugald Clerk.

JOHN H. BARNARD.
Lieut. Comdr.
U. S. N. R. F. 1,
New York.

POWER PLANT MEN READ "MOTORSHIP"

To the Editor of MOTORSHIP:

I am receiving your copies of MOTORSHIP and like it fine. I am in charge of a Diesel-electric lighting station for this town, and we have a 200-b.h.p. Mirrlees 4-cycle 4-cylinder engine direct-connected to a 3-phase alternating generator. We have also a 525 Atlas Diesels-Motorer engine (Polar), built at Stockholm, direct-connected to a 375-k.w. generator.

Your Year-Book showed me a number of things that I needed, and helped me with a few problems. Being in an outside place, we are at a disadvantage and have to rely upon ourselves. Last year the only stoppages we had (outside of regular shut-down for cleaning valves and overhaul) was 35 minutes during a heavy lightning storm, and 30 minutes for water stoppage. This lighting station is known from coast to coast, according to reports we have had, for its good service and its cleanliness. I think that you should have a few pages in your regular issue on problems which crop up in stationary Diesel-stations, which would be of great benefit to men in outside places.

B. B. HODGSON.
Vernon, B. C. Canada.

[Such an article was published in two installments during 1918. It covered the operation of a plant having five different makes of Diesels.—*Editor.*]

FROM AN OLD READER NOW IN MEXICO

To the Editor of MOTORSHIP:

The writer is an old reader of MOTORSHIP ever since his residence and Diesel marine work in Seattle, Wash., being very familiar with your publication.

P. L. BELL.
American Trade Commissioner,
U. S. Department of Commerce,
Mexico, D. F.

THE TANADA-T. DIESEL ENGINE

To the Editor of MOTORSHIP:

Is it not possible to obtain more information regarding the very interesting engine shown in the June issue of MOTORSHIP by Tanada T.?

FORREST E. JONES.
Waco, Tex.

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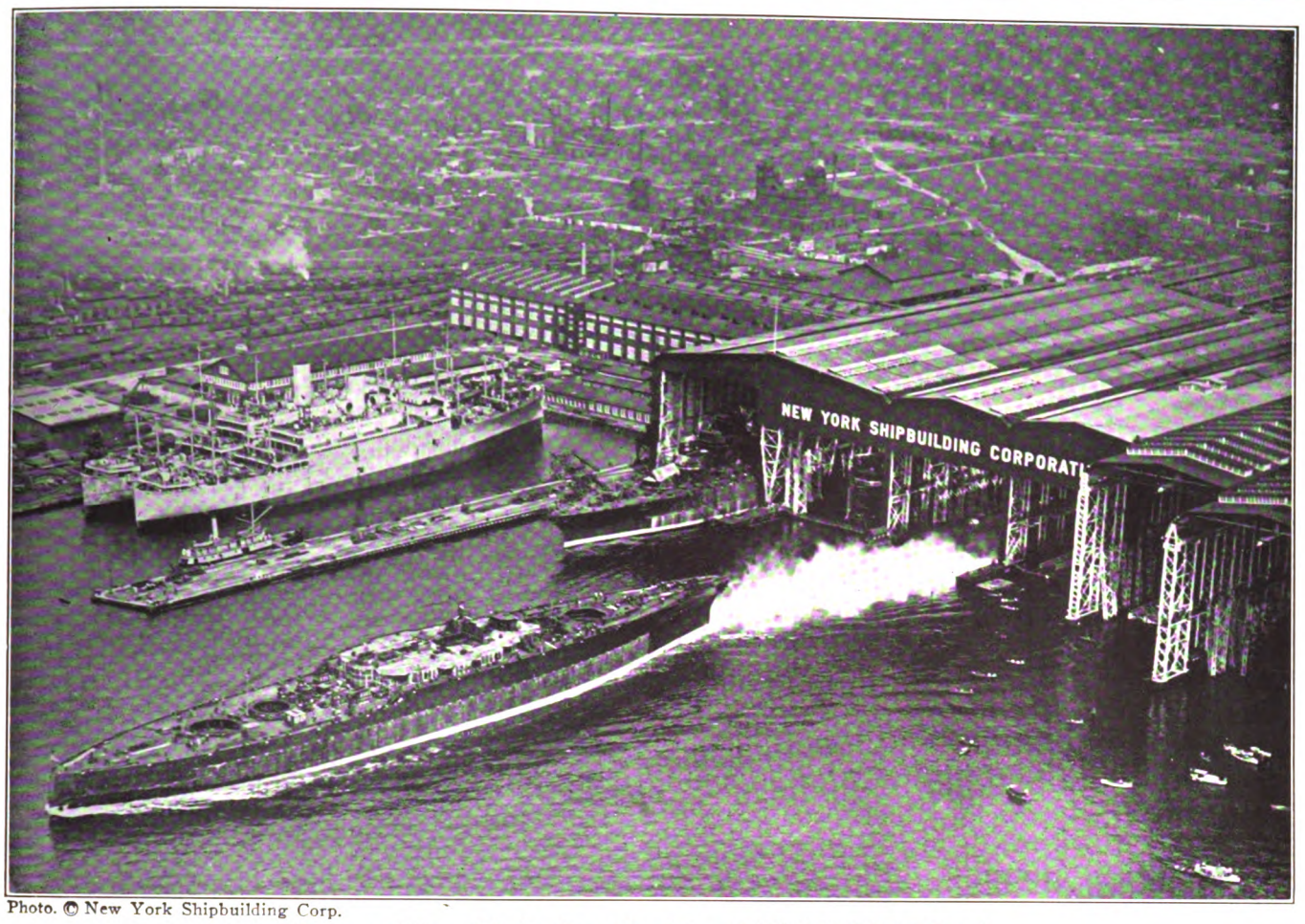


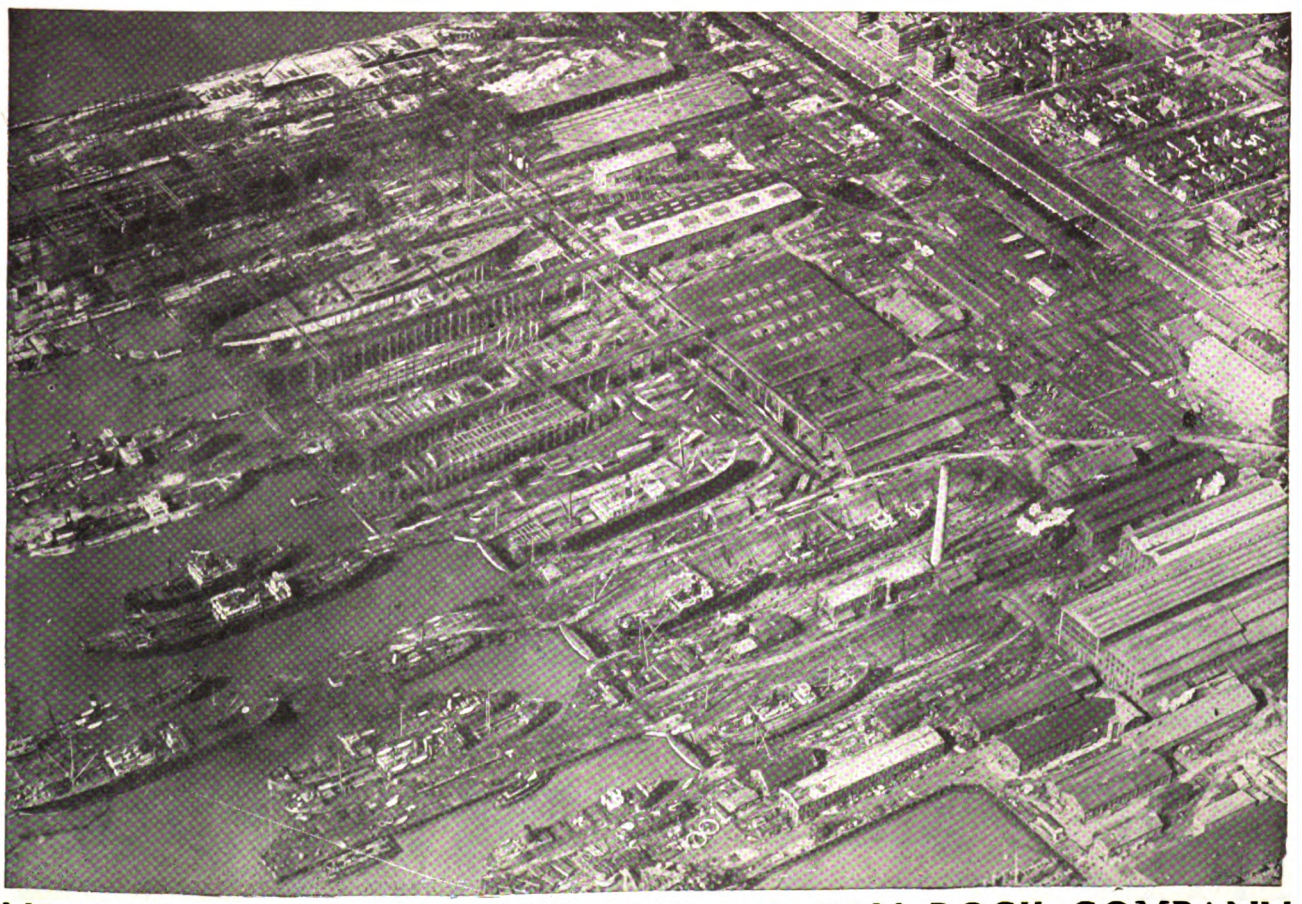
Photo. © New York Shipbuilding Corp.

Launching U. S. Battleship "WASHINGTON"

NEW YORK SHIPBUILDING CORPORATION

MAIN OFFICE AND WORKS

CAMDEN, NEW JERSEY, U. S. A.



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SHIP BUILDERS AND SHIP REPAIRERS

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